re-BUS

You have downloaded a document from
RE-BUŚ
repository of the University of Silesia in Katowice

Title: The Evolutionary Subject : Science Fiction from the Perspective of Darwinian Literary Studies

Author: Bartłomiej Kuchciński

Citation style: Kuchciński Bartłomiej. (2019). The Evolutionary Subject : Science Fiction from the Perspective of Darwinian Literary Studies. Praca doktorska. Katowice : Uniwersytet Śląski

© Korzystanie z tego materiału jest możliwe zgodnie z właściwymi przepisami o dozwolonym użytku lub o innych wyjątkach przewidzianych w przepisach prawa, a korzystanie w szerszym zakresie wymaga uzyskania zgody uprawnionego.

UNIWERSYTET ŚLĄSKI W KATOWICACH
Biblioteka Uniwersytetu Śląskiego
Ministerstwo Nauki i Szkolnictwa Wyższego

UNIVERSITY OF SILESIA IN KATOWICE
FACULTY OF PHILOLOGY

BARTŁOMIEJ KUCHCIŃSKI
5118

THE EVOLUTIONARY SUBJECT: SCIENCE FICTION FROM THE PERSPECTIVE OF DARWINIAN LITERARY STUDIES

PHD THESIS

SUPERVISOR: Prof. zw. dr hab. Wojciech Kalaga

SOSNOWIEC, 2019

UNIWERSYTET ŚLĄSKI W KATOWICACH
WYDZIAŁ FILOLOGICZNY

BARTŁOMIEJ KUCHCIŃSKI
5118

PODMIOT EWOLUCYJNY: FANTASTYKA NAUKOWA Z PERSPEKTYWY LITERATUROZNAWSTWA DARWINISTYCZNEGO

ROZPRAWA DOKTORSKA

Praca w języku angielskim

PROMOTOR: Prof. zw. dr hab. Wojciech Kalaga

SOSNOWIEC, 2019

Table of Contents

INTRODUCTION

> What are the facts? Again and again and again – what are the facts? Shun wishful thinking, ignore divine revelation, forget what "the stars foretell," avoid opinion, care not what the neighbors think, never mind the unguessable "verdict of history" – what are the facts, and to how many decimal places? You pilot always into an unknown future; facts are your single clue. Get the facts!
>
> Robert A. Heinlein

There are peculiarities about science fiction and its study that can only be described as, to use a slightly modified phrase by William Gibson, paradoxical antagonisms. On the one hand, science fiction is overtly concerned with explorative encounters with radical novelty and yet, on the other hand, much of its poetics and thematic focus is surprisingly repetitive and formulaic. The repetitiveness does not seem, however, to affect science fiction's popularity nor its entertainment or artistic value. To the contrary, many works of science fiction continue to be among the most popular, relevant and most critically acclaimed books or films of all time.

A paradox of a different type concerns the academic study of science fiction. While it has a fairly long and a certainly rich history, there seem to be interesting gaps in it. In very rough terms, science fiction studies fall into two categories: the theoretical and the practical. The theoretical works are more focused on the formal aspects of science fiction (what makes science fiction science fiction) and thus its position vis-à-vis other types or genres of literature. The practical criticism of science fiction is, in turn, more interested in specific themes, problems or even particular authors and thus the relations between science fictional texts and broader cultural, social or political contexts.

These two general categories of science fiction studies are indicative of a certain general characteristic of literary theory. The theoretical analyses all operate in the realm of specialized academic discourse of literary studies which, even though a

constituent part of the humanities, leaves very little space to account for the presence of the human agency of both the authors and their audiences in the creation and reception of science fiction. The more practically oriented studies, rather than being too far removed from the human factor, are in turn too specific in their piecemeal approach of analyzing given texts, or sets of texts, from particular analytical perspectives.

The result is a constellation of, oftentimes brilliant, critical texts which, in its totality, lacks an integrating element, or an overarching meta-theory that would allow for relating the results of critical or interpretative explorations to one another. Because of that, even though both categories include analyses from an extremely large variety of perspectives, it is somewhat puzzling to note that there seem to be a number of elephant-in-the-room type of questions concerning science fiction that are seldom, if ever, asked, much less answered (and even if, then in terms far too general to be considered satisfactory): if radical novelty (Todorov's "scientific marvelous" or Suvin's "novum") is the central formal feature of science fiction, how is that novelty (otherness or alienness) realized? What mechanisms govern the creation of novelty and what makes formulaic encounters with it not only entertaining but intellectually stimulating and culturally relevant? How does science fiction elicit a continuous interest in itself despite its formulaicness? What are the narrative patterns and what is their function? And, perhaps most importantly: *what is science fiction even for*? It is the aim of this thesis to answer these fundamental questions by introducing a meta-theory of science fiction derived from the insights of Darwinian Literary Studies.

There is a noticeable tendency to regard Darwinian Literary Studies as both a marginal and an unwanted area of literary theory. A bastard child of natural sciences and anti-postructuralist positions within Theory, this relatively recent approach to the

study of literature distances itself from what it considers the dominant theoretical paradigms and is an attempt to explain the functions and the forms of literature in terms consistent with evolutionary psychology, and consequently, with the broader evolutionary paradigm. This paradigm, as Dominika Oramus argues in her recent book *Darwinowskie paradygmaty. Mit teorii ewolucji w kulturze współczesnej*, is not only the *de facto* organising paradigm for the life sciences, but has also established itself as a powerful presence in culture. As Oramus shows, evolutionary theory has profoundly influenced and shaped discourse in theology, teleology and metaphysics. It has codified the popular image of a scientist and of science itself. It has also proved to be a potent source of inspiration for the popular discourse of science fiction which insistently turns towards genetics, mutations and reversed, accelerated or otherwise alternative evolutions as its thematic focus.[1]

Despite its apparent marginality within literary studies, the influence of evolutionary theory on the humanities as a whole, has been significant. The publication of Edward O. Wilson's 1971 *Sociobiology,* in which the author attempted to apply evolutionary criteria to the study of human behaviour sparked a massive controversy and a long series of debates and arguments. Ullica Segerstrale's enormous (twenty chapters long) book *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond* provides a detailed analysis of the controversy, the length, intensity and the complexity of which lead the author to treat it and to present it as an opera in three acts, complete with the authors invitation to the reader to imagine the actual music scores. Dramatic as the sociobiology controversy was, in its result "during the last three decades or so the idea of a

[1] See: Dominika Oramus, *Darwinowskie paradygmaty. Mit teorii ewolucji w kulturze współczesnej* (Kraków: Copernicus Center Press, 2015)

biological foundation for human behaviour has become more acceptable on both scientific and intellectual grounds."[2]

The gradual acceptance for the sociobiologist programme constitutes one part of developments which lead to the emergence of Darwinian Literary Studies. The other element is the growing sense of disappointment with post-structuralist and post-modernist conceptions which came to dominate literary theory since at least the 1970s. The Sokal Affair and the publications of Gross and Levitt's *Higher Superstition: The Academic Left and Its Quarrels with Science* in 1994 and Sokal and Bricmont's *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science* in 1998 made it apparent that there are flaws in both the practice of critical theory and its constructivist tenet of the primacy of discourse.

These two developments opened ground for the emergence of a form of literary study which seeks to reconcile itself with the natural sciences under the meta-narrative conception of scientific consilience, presupposing that biological and evolutionary explanations of human behaviour reached by the natural sciences have to be applicable in the analysis of cultural phenomena and that, vice versa, the conclusions of research conducted within the humanities cannot stand at odds with those of the natural sciences.

Thus, Darwinian Literary Studies turn to evolutionary sciences as a necessary intermediary between the human and the natural sciences, in order to derive and form principles of literary theory. What DLS entails is the focus on the search for evolved psychological mechanisms which influence the structure and content of cultural creations and the inquiry into the possible functions of these creations in relation to the central evolutionary problems of fitness and adaptiveness. In more practical

[2] Ullica Segerstrale, *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond*(Oxford: Oxford University Press, 2000), p. 308

terms, the Darwinian study of literature requires an approach to literary texts from an angle different than other forms of literary criticism. It enforces a change of focus, from a "what happens" type of approach to "why and how something happens." In a more technical formulation, DLS focuses more on the mechanisms governing the process of cultural creation rather than on the actual process itself. Taking this character of DLS into account it should become apparent why it is an approach particularly suited to answer the questions outlined above and to address the gap in science fiction studies which the existence of these questions signifies.

The thesis is organised into four chapters. Chapter 1 discusses the increasing biological awareness of the present cultural moment manifested in the growing scope, effectiveness and even popularity of evolutionary research in a number of related disciplines, from palaeontology to genetics. It introduces E.O. Wilson's idea of scientific consilience and provides an overview of some of the most prominent evolutionary perspectives on human behaviour in order to provide an outline of the evolutionary paradigm which forms the basis of Darwinian Literary Studies.

Chapter 2 engages more directly with literary theory. It first considers the essentially reactionary character of Darwinian Literary Studies, introduces its major conceptual premises and the theoretical framework and scope of the field. The chapter then discusses the possibility thatby acquainting the reader with the generalised notions of novelty, strangeness and otherness, and by culturally perpetuating a set of adaptively motivated responses to these notions, science fiction serves an adaptively beneficial, fitness-enhancing role.

Chapters 3 and 4 are devoted to the analysis of the two crucial elements of the poetics of science fiction, exploration and alienness respectively, in relation to its potentially adaptive function, discussed in the previous chapter. Chapter 3 focuses on

the narrative pattern of a journey from a highly regulated heterotopic space into the unregulated paraspace outside of it and links it with a set of innate tendencies of landscape exploration. Chapter 4 considers the role of disgust as a primary means of evoking estrangement, and thus, its crucial role in organising the science fictional aesthetics. Both chapters foreground the interplay between curiosity and fear implicit in the encounter with radical otherness and thus aim to address the paradox of the formulaicness of science fictional novelty.

Due to the wealth of the material available, the texts, films and video games discussed in these chapters are not chosen on the basis of any clearly definable criteria other than their popularity and their representativeness of either the genre or of the phenomenon which they illustrate. This lack of systematicity in the selection of research material, while normally a flaw, is premeditated. Over the course of the past decade, I have read over two hundred science fiction novels and short-story collections. It would obviously be impractical to include all of them in the discussion nor would it be reasonable to provide lists of titles that can be used as supporting evidence for the claims made in the thesis. The additional benefit of this somewhat random selection of analysed material is that the lack of a pre-defined analytical key showcases the predictive character of the claims made in the thesis.

The conclusion summarises the analysis and presents a consolidated account of the research's findings. It also addresses the limitations of Darwinian Literary Studies and comments upon its value and significance for literary theory.

CHAPTER 1: INTO THE FRAY: THE SOCIOBIOLOGICAL PARADIGM AND SCIENTIFIC CONSILIENCE

> Like every other creature on the face of the earth, Godfrey was, by birthright, a stupendous badass, albeit in the somewhat narrow technical sense that he could trace his ancestry back up a long line of slightly less highly evolved stupendous badasses to that first self-replicating gizmo – which, given the number and variety of its descendants, might justifiably be described as the most stupendous badass of all time. Everyone and everything that wasn't a stupendous badass was dead.
>
> Neal Stephenson, *Cryptonomicon*

When the anthropologist Robert Augner cheerfully announces the coming of an "Age of Universal Darwinism"[3] or when the philosopher Daniel Dennett speaks of the idea of natural selection as a "universal acid"[4] biting its way through science and culture alike, they are not being merely expressively optimistic in their propagandising. Instead, they point to the profundity of the phenomenon of growing biological and evolutionary awareness, a broad process of emergence of a series of discoveries and consequent paradigmatic shifts proceeding along three different vectors, all sharing the same point of origin, yet pointing in different directions: backwards through evolutionary biology and evolutionary anthropology, forwards through genetics and biotechnology and inwards through sociobiology and evolutionary psychology. This chapter provides a brief overview of the three lines of inquiry, focusing on the third one, as it constitutes the conceptual basis for the development of Darwinian Literary Studies.

---

[3] Robert Augner, "Introduction," in: *Darwinizing Culture. The Status of Memetics as a Science* (Oxford: Oxford University Press, 2000), p. 1.

[4] Daniel Dennet, *Darwin's Dangerous Idea. Evolution and the Meanings of Life* (London: Penguin Books, 1996), p. 63.

The Scope of Darwinist Thought

The backwards, past-oriented research vector, the reconstruction of human evolutionary history, is at the same time the oldest, the best established and presently appears to be scientifically least controversial of the three. It forms the basis and the foundation for the other two, both in terms of scientific and cultural significance. At present, the human lineage, from the *homo habilis*, through *homo erectus* and on to the *homo sapiens* is obvious, the progression clear and apparent, the fossil record forming a more or less continuous picture. Within it there are of course areas of uncertainty and discontinuity such as the mystery of the exact relation between the *homo sapiens* and the *homo neanderthalis* and the ultimate fate of the latter. New discoveries are also made, the most recent, and extremely puzzling, being the *homo florienensis*, a pygmy *homo* subspecies averaging about 1 meter in height. The mysteries, however, do not disturb the overall picture of human descent, nor do they threaten to uproot the paradigm. Instead, they offer a possibility of creating a fuller and more accurate description of human evolutionary history, each discovery filling a gap in the network of knowledge. [5]

The second vector of inquiry is future-oriented, and proceeds from the advancements made in the fields of molecular biology, genetics, and a host of other fields loosely termed "biotechnology," all developed as a direct consequence of probing into the very mechanisms of heredity, the vehicle for natural selection. Here, the progress is also clear: from the discovery of genes, through the description of the structure and nature of the DNA and onwards to the complete mapping of human and animal genomes. These achievements in turn open a myriad of new

[5] For an overview see: Robert Foley, *Unknow Boundaries: Exploring Human Evolutionary Studies* (Cambridge: Cambridge University Press, 2006).

possibilities, opportunities and challenges across the spectrum ranging from traditional medicine and pharmacology at the conservative end, through the controversial and hotly debated issues of stem cell research and transplantology, all the way to the radical propositions of direct interventions into the genome raised by the more extremist activists grouped under the moniker of "transhumanists."

The speed at which research along this vector proceeds is staggering and a comprehensive description would be both immensely difficult and well beyond the scope of the present study. There are, however, two telling examples, testifying to the ubiquity and scope of the bio-oriented research. The Folding@home project, led by Pande Lab, a part of the Departments of Chemistry and of Structural Biology, Stanford University and Stanford University Medical Center researches the process of protein folding, that is, the translation of a fragment of genetic code into a self-assembled functional protein. The goal of the project is to "simulate protein folding in order to understand how proteins fold so quickly and reliably, and to learn about what happens when this process goes awry (when proteins misfold)."[6] Diseases such as Alzheimer's, Huntington's and the BSE are believed to result from misfolding of proteins. The most striking element of the project, however, is its "@home" component. The simulation and research are conducted by means of a distributed computing network in which thousands of volunteers participate by downloading client software which automatically downloads a sample to analyse and returns the results to the central server. The client program operates only when the user's computer is not occupied otherwise, thus effectively using the "spare" computing power and it used to be available even for the Sony Playstation 3 *gaming* console. As of May 16th 2012 there are 8185045 processors active in the project with the

[6] http://folding.stanford.edu/English/Science (16 May, 2012).

computing power of over 7000 x86 TFLOPS[7] (for comparison: the Cray XT5 Jaguar supercomputer operates at the peak of 1750 TFLOPS[8]). The project has resulted in the publication of 96 papers since its start in 2000.[9]

A parallel project, Rosetta@home, run by the Baker Laboratory at the University of Washington and based on the popular BOINC client (Berkeley Open Infrastructure for Network Computing), focuses on predicting the possible protein structures and also conducts side research focusing on Alzheimer's disease, malaria, HIV and the herpes virus.[10] As of May 16th 2012 the project boasts over 300 000 active users and moves onward at an estimated speed of 119 TFLOPS.[11]

Important though the discoveries of the two projects might be, they are not critical to the present discussion. What is important, however, is their magnitude and the scale of numbers of people and computers involved in them, clearly illustrating the magnitude, the *popularity* and the apparent attractiveness of said research projects, again testifying to the biologically-oriented character of the "present cultural moment."

Poised at the extreme end of this moment is a group of thinkers, scientists and activists identifying themselves as transhumanists. Their general objective is to "push the boundaries of humanity," which in the techno-scientific dimension translates into their vocal advocacy for the use of advanced technology, including genetic engineering, pharmacology, nanotechnology and cryonics, to radically intervene into the very composition of the human body in order to eliminate diseases and genetic disorders, increase human lifespan and to liberate the human species from its

[7] http://folding.stanford.edu/English/Stats (16 May, 2012).
[8] http://i.top500.org/system/176544 (16 May, 2012).
[9] For the list see: http://folding.stanford.edu/English/Papers (16 May, 2012).
[10] http://boinc.bakerlab.org/rosetta/rah_about.php (16 May, 2012).
[11] http://boinc.bakerlab.org/rosetta/ (16 May, 2012).

biological constraints. For all their naïve optimism, it is becoming ever more apparent that the technology required to meet the transhumanist proposals is either already available or is being presently developed[12] and both the transhumanists and their opponents recognise the imminence of the oncoming changes. James Hughes, the former executive director of the World Transhumanist Association writes with certainty:

> [i]n the twenty-first century the convergence of artificial intelligence, nanotechnology, and genetic engineering will allow human beings to achieve things previously imagined only in science fiction. Life spans will extend well beyond a century. Our senses and cognition will be enhanced. We will gain control over our emotions and memory. We will merge with machines, and machines will become more like humans. These technologies will allow us to evolve into varieties of 'posthumans' and usher us into the 'transhuman' era and society[13]

and thus echoes in reverse a point made by Francis Fukuyama in the *anti*-biotechnological *Our Posthuman Future,* where Fukuyama argues that "Huxley was right, that the most significant threat posed by contemporary biotechnology is the possibility that it will alter human nature and thereby move us into a 'posthuman' stage of history."[14]

Where Hughes sees opportunity, Fukuyama sees a threat, but both agree that there exists a necessity to respond to the challenges already looming over the technological, cultural, political and ethical horizons by adjusting the political and ethical discourses to meet those challenges. And, non-accidently, both writers legitimise their points by a reference to science fiction, testifying to its privileged

---

[12] See: Roco, Mihail, William S. Bainbridge, eds. *Converging Technologies for Improving Human Performance* (Washington, D.C.: National Science Foundation, 2002).

[13] James Hughes, *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future* (Westview Press, 2004), p. xii.

[14] Francis Fukuyama, *Our Posthuman Future. Consequences of the Biotechnology Revolution* (New York: Picador, 2002), p. 5.

status in the emergent bio-discourse, a point that shall be expanded upon in the following chapter.

To understand that role it is necessary to take into account the third, inwardly pointed vector of evolutionary research. It is the evolutionary analysis of the human brain and mind and the behaviours they produce, and it is of particular interest to the humanities and the humanists inasmuch as it presents a new conception of the human psyche, an evolutionary account of the elusive human nature, and has already been appropriated to form the basis of a school of literary criticism. This school of Darwinian literary studies is a manifestation of a farther reaching project of (re)uniting the natural sciences, the social sciences and the humanities, using the idea of scientific consilience as its legitimising factor.

Two works by Edward O. Wilson form the conceptual framework of these branches of evolutionary study. In the scientific dimension it is the 1971 *Sociobiology: A New Synthesis*; in the philosophical dimension it is *Consilience: The Unity of Knowledge*. The former opened the very possibility of applying evolutionary approach to studying human behaviour by focusing on the impact of human evolutionary conditioning on the shape of elements constituent of human cultures, the latter forms a conceptual framework for a restored meta-narration for the humanities, encouraging and justifying a profound interdisciplinarity. This interdisciplinary explanatory pluralism is emblematic of the Darwinian approach to analysing human behaviour.

Evolutionary Explanations of Human Behaviour

Sociobiology, as developed by researchers such as Robert Trivers, George Williams, William Hamilton and John Maynard Smith, focused on the functional significance

of animal behaviour, that is it sought to explain why evolution selected a particular behaviour and how it could be considered an adaptation.[15] The sociobiologists mentioned first introduced such concepts as the gene's-eye view, reciprocal altruism, kin selection and evolutionary game theory.

The gene's-eye view approach proved to be a key concept for the sociobiologist program. It was developed in response to the idea of group selection, whose advocates claimed that "many aspects of the social behaviour of animals could be explained by the idea that animals made sacrifices for the good of the group. "[16] V.C. Wynne-Edwards, a Scottish ethologist, argued in *Animal Dispersion in Relation to Social Behaviour* (1962) that in order to avoid overpopulation, potentially leading to a population crash in a habitat with limited resources, some individuals might altruistically forego reproduction in order not to put additional strain on the already scarce resources. Wynne-Edwards indicated that animal vocalisations and displays were means to enable individuals to assess population density and influence the reproductive decisions.[17]

John Maynard Smith, David Lack and George C. Williams would challenge the group selection approach, arguing that the phenomena described by Wynne-Edwards could be better explained in terms of individuals trying to maximize their *own* reproductive success. Williams in *Adaptation and Natural Selection* (1966) argued against group selection by pointing out that the movement of individuals between groups would weaken group selection and, more importantly, that those individuals who would be able to cheat the system, would out-compete other members of the population and could reproduce at their cost. Instead of group

---

[15] Kevin Laland, Gillian Brown, *Sense and Nonsense: Evolutionary Perspectives on Human Behaviour* (Oxford: Oxford University Press, 2002), p. 69.

[16] Laland, Brown, *Sense and Nonsense*, p. 73.

[17] Laland, Brown, *Sense and Nonsense*, p. 73-74.

selection, Williams offered an explanation from the perspective of a gene and the characteristics it would need to have in order to increase the chances of its representation in the next generation. Williams argued that a gene that would delay reproduction if the external conditions were so disadvantageous for the individual that it would be a waste of effort to engage in reproduction, might give the said individual a selective advantage over a gene compelling its carrier to engage in reproduction at all cost.[18]

The gene's-eye view was encapsulated, perhaps misleadingly, in the slogan of "the selfish gene," made famous by Richard Dawkins' book of that title published in 1976. Not only did the book bring the gene's-eye perspective to a mass audience, but it also introduced the important concept of the "meme," discussed later.

Assuming the gene's view perspective proved to be a key element in explaining many problems which the biologists opposed to the idea of group selection had to face. One of these was the problem of altruism of an individual which forfeits its own chances of reproduction on behalf of another individual.

In 1964 William Hamilton proposed a solution based on kinship. Related individuals share significant amount of copies of the same genes, and thus, by helping close kin to reproduce, they may increase the frequency of these common genes in the future generations.[19] This type of behaviour will be selected, Hamilton argued, when the cost to the altruist is lower than the expected benefit to the relative multiplied by the probability of the relative possessing the same genes. In two papers published in 1964 in *The Journal of Theoretical Biology* under a joint title "The Genetical Evolution of Social Behaviour," Hamilton presented a mathematical

[18] Laland, Brown, *Sense and Nonsense*, p. 74-75.

[19] William Hamilton, "The Genetical Evolution of Social Behaviour I," *Journal of Theoretical Biology* 7 (1964), p. 1.

formula for predicting when altruistic behaviour was likely to occur: $c<br$ (where *c* is the cost of the altruistic behaviour, *b* is the benefit of the recipient, and *r* is the probability of the beneficient possessing the same genes as the donor).

John Maynard Smith coined the phrase "kin selection" to refer to this type of behaviour and defined it as "the evolution of characteristics which favour the survival of close relatives of the affected individual, by processes which do not require any discontinuities in the population breeding structure."[20] Further research of altruistic behaviour led Robert Trivers to introduce the idea of reciprocal altruism. Trivers maintained that if even unrelated individuals interacted over an extended period of time, they might behave altruistically if there was a high probability that it would be reciprocated in the future. Though such a behaviour would be initially costly to the benefactor, over time both individuals involved would benefit, provided that the possibility of cheating and not reciprocating is eliminated. Trivers thus recognised, that reciprocal altruism is more likely to occur in populations with low dispersal rates, where individuals interact regularly and have a memory of previous interactions so that the cheaters are excluded from receiving altruistic benefits.[21]

Trivers came to a conclusion that reciprocal altruism "in the human species takes place in a number of contexts and in all known cultures"[22] and attributed it to living conditions of the human Pleistocene ancestors, which met the criteria necessary for its development (stable groups, extended period of interactions, discrimination against cheaters). Trivers also argued that a number of human characteristics can be explained by reciprocal altruism. For instance, friendship can be understood in terms of engendering altruistic acts, but at the same time, altruistic

[20] John Maynard Smith, "Group Selection and Kin Selection," *Nature* 201 (4924) (1964), p. 1145-1147.

[21] Robert Trivers, "The Evolution of Reciprocal Altruism," *The Quarterly Review of Biology* vol. 46 No.1 (1971), p. 45.

[22] Trivers, "The Evolution of Reciprocal Altruism," p. 45.

acts serve to strengthen friendship. Likewise, moralistic aggression is a "protective mechanism" against unreciprocating individuals whose aim is

> to educate the unreciprocating individual by frightening him with immediate harm or future harm of no more aid; and in extreme cases, perhaps, to select directly against the unreciprocating individual by injuring, killing or exiling him.[23]

Even despite the protective mechanisms in place, there exists an allowance for subtle cheating in which the recipient reciprocates but not as much as is expected of them. Trivers also suggested that gratitude regulates human response to altruistic acts and that it is sensitive to the cost/benefit ratio of these acts: the higher the benefit to the recipient the greater the gratitude and thus, possibly, the greater the future reciprocity.[24] To provide means of calculating and describing complex trade-offs involved in reciprocal altruism, scientists analysing them turned to the economic game theory. Its evolutionary application is concerned with the dependency between an individual's behaviour and the behaviour of those around them. The goal is to analyse all possible strategies of behaviour against each other and to identify which would prove to be the most efficient and, consequently, the most evolutionarily stable.[25]

This early form of sociobiology, with its interesting and relevant contributions to the study of animal social behaviour, would probably remain a fairly uncontroversial discipline but for the publication of Edward Wilson's *Sociobiology: The New Synthesis* in 1975.[26] In the final chapter Wilson speculated about the evolutionary functionality of such specifically human traits as gender roles and religion and he made a case for rethinking social sciences so that they could be

---

[23] Trivers, "The Evolution of Reciprocal Altruism," p. 49.
[24] Trivers, "The Evolution of Reciprocal Altruism," p. 49.
[25] Laland, Brown, *Sense and Nonsense*, p. 85.
[26] Segerstrale, *Defenders of the Truth*, p. 53.

connected with sociobiology. In that same chapter, Wilson asked a number of crucial questions: how much have the genetic traits developed in the past influenced the construct of human society? How flexible are these traits? How much are human traits adapted to the contemporary world and how much to the past environments? These questions would come to define the whole sociobiological family of sciences.

Wilson seems to agree with Dobzhansky's claims of cultural processes gaining primacy over the genetic predispositions, yet he insists that genetic factors should not be completely excluded from the analyses of human behaviour. Instead Wilson argues for something of a cross between anthropology and genetics that would provide a fuller understanding of man. He summarised his ideas in the following way:

> Human beings inherit a propensity to acquire behavior and social structures, a propensity that is shared by enough people to be called human nature. The defining traits include division of labor between the sexes, bonding between kin, incest avoidance, other forms of ethical behavior, suspicion of strangers, tribalism, dominance orders within groups, male dominance over-all, and territorial aggression over limiting resources. Although people have free will and the choice to turn in many directions, the channels of their psychological development are nevertheless [...] cut more deeply by the genes in certain directions than in others. While cultures vary greatly, they inevitably converge toward these traits.[27]

Needless to say, the proposition of such a radical reorientation of thinking of humans provoked a heated response. Events unfolding in the following years were, indeed, quite dramatic and the actual sequence of academic exchanges, arguments, debates attacks and counter-attacks (including actual physical assaults) is as intriguing as it is convoluted. Wilson's proposed programme was accused of genetic prejudice, storytelling, reductionism and genetic determinism, and as a consequence of fierce debates raging over it has largely been re-labelled and re-modelled.

---

[27] Edward Wilson, *Naturalist* (Washington, DC: Island Press, 1994), p. 332-333 .

Among the chief critics of sociobiology was Richard Lewontin, who together with Rose and Kamin wrote in *Not in Our Genes* that "Sociobiology is a reductionist, biological determinist explanation of human existence. Its adherents claim […] that the details of present and past social arrangements are the inevitable manifestation of the specific action of genes."[28] This criticism is largely unfounded because sociobiology has always accepted the view that genes are not the *sole* influence on human behaviour, even if they play a part in influencing it. Hence evolutionary analyses should focus on the genes not because they are the only factor determinant of behaviour, but because they are the only heritable factor, and thus the only one that might be subject to natural selection.[29] Laland and Brown point out that similar controversies over genetic determinism may come from the misunderstanding of the phrase "gene for." A "gene for" a behaviour would not make that behaviour inevitable and fixed, but would merely denote that a particular behaviour might be preferred.[30]

Other serious criticisms of sociobiology concerned its political aspects. Wilson's explanations of sex differences were considered conservative and promoting sex inequity, while his suggestions that there might be differences in mental aptitudes between different races opened the possibility of racist interpretations. Wilson, Dawkins and Maynard Smith had published letters in which they denied racist and extreme-right positions any place in sociobiology and disassociated themselves from such interpretations.[31]

---

[28] R. Lewontin, L.Kamin, S.Rose, *Not in Our Genes: Biology, Ideology and Human* Nature, (London: Penguin Books,1984), p. 236.

[29] Brian Baxter, *A Darwinian Worldview: Sociobiology, Environmental Ethics, and the Work of E.O. Wilson* (Burlington: Ashgate, 2007), p. 30.

[30] Laland, Brown, *Sense and Nonsense*, p. 95-96.

[31] Laland, Brown, *Sense and Nonsense*, p. 98-99.

Perhaps the strongest criticism of sociobiology centred around the view that it was doing little more than producing plausible stories of evolutionary foundations of behaviour. Lewontin, Rose and Kamin claimed that "imaginative stories have been told for ethics, religion, male domination, aggression, artistic ability, etc. All one need do is predicate a genetically determined contrast in the past and then use some imagination, in a Darwinian version of Kipling's *Just So Stories*."[32] While the possibility of concocting evolutionary Just-So stories certainly exists, it is easily eliminated by the scientific heuristics of meticulous and rigorous research, in favour of which Wilson obviously argued. An allegation of reaching hasty conclusions based on insufficient evidence can be made against researchers in any field, yet it would not undermine the general validity of that field. Nonetheless, an over-eager approach of certain sociobiologists which led them to produce superficial explanations of behaviour, often focusing solely on their evolutionary aspects with disregard to non-evolutionary factors, has been largely recognised and was certainly detrimental to the reception of sociobiologist ideas.

In the light of these criticisms, sociobiology was largely rejected by social scientists. Ultimately, however, as Ullica Segerstrale writes, "Wilson's important contribution consisted in the fact that he created a field by showing its scattered practitioners that it *existed.* And Wilson not only gave the field a name, he also advocated its feasibility and importance in a social climate suspicious of evolution and the genetics of behavior."[33] One result of the aggressive debate over sociobiology was that it brought its ideas to a wider attention, which, in turn, inspired a host of other evolutionary approaches to analysing and explaining human behaviour.

---

[32] Lewontin, Rose, Kamin, *Not in Our Genes*, p. 258.

[33] Segerstrale, *Defenders of the Truth*, p. 4.

Spurred by the sociobiological debates, a number of scientists undertook a program of testing the ideas of sociobiology against data collected from real populations. With the main premise being that human behaviour strategies are indeed adaptive across a range of ecological and social conditions, the point of interest became whether human behaviour could flexibly adjust to changing environmental conditions. Whereas traditional anthropology focuses on how culture influences behaviour, Darwinian anthropology, labelled as human behavioural ecology, does the opposite: its aim is to "determine how ecological and social factors affect behavioural variability within and between populations"[34] and how the said variability produces cultural differences. While the research focused on traditionally anthropological topics such as kinship, marriage and social stratification using methods and data of typically anthropological varieties, "[t]he novel element was the use of such data to test hypotheses derived from the theoretical expectation that human social behaviour would reflect strategies that would enhance inclusive fitness in environments similar to those of past human evolution."[35]

The central notion of behavioural ecology is that humans are able to flexibly alter their behaviour in response to changing environmental factors, in order to maximize their reproductive success. Behavioural ecologists claim that humans are able to adjust their strategy by weighing up the benefits and costs of a given behaviour and choosing the optimal solution (i.e., one that maximizes the benefit-cost difference). The adjustment is considered to be rapid, hence behavioural

[34] M. Borgerhoff Mulder, "Human behavioural ecology" in: *Behavioural Ecology: an Evolutionary Approach, eds.* J. Krebs, N. Davies (Oxford: Blackwell Scientific Publications, 1991), p. 69.

[35] William Irons, Lee Cronk, "Two Decades of a New Paradigm," in: *Adaptation and Human Behaviour: An Anthropological Perspective*, eds. L. Cronk, N. Chagnon, W. Irons (New York: Aldine de Gruyter, 2000), p. 5.

ecologists would claim that there is little adaptation lag between behaviour and the socioecological environment in which it takes place.[36]

In practice, behavioural ecology consists in testing optimal models of behaviour, built on the basis of mathematical evolutionary theory, against actual behaviour displayed in a given situation. If the data fit the model, the hypothesis of the model providing an accurate description of a behavioural strategy is upheld. The same process is repeated in different environments and the data can be compared. If, in turn, the data do not support the model, it can either be revised and re-tested until it eventually provides an understanding of a particular population or the model can be rejected with the conclusion that people do not behave optimally in a given situation.[37] Human behavioural ecologists assume a piecemeal approach, and maintain that a reductionist approach – analysing singled-out aspects or elements of even very complex behaviour – can prove to be fruitful. If relatively simple analytical models provide researchers with testable hypotheses, they can be combined and extended into a fuller description.[38]

The behavioural ecology research programme, too, came under heavy criticism. Donald Symons argued that behavioural ecology did not indeed form hypotheses about human adaptations but "established which behaviour patterns appeared adaptive."[39] Symons drew attention to the distinction between *an adaptation*, that is a character favoured by natural selection, and a character that is *adaptive*, i.e., currently performing a function which increases reproductive success. Consequently, it becomes clear, that certain human adaptations might no longer be

[36] Eric A. Smith, "Three Styles in the Evolutionary Analysis of Human Behavior," in: *Adaptation and Human Behaviour: An Anthropological Perspective*, eds. L. Cronk, N. Chagnon, W. Irons (New York: Aldine de Gruyter, 2000), p. 30.

[37] Laland, Brown, *Sense and Nonsense*, p. 116.

[38] Smith, "Three Styles in the Evolutionary Analysis of Human Behavior," p. 29-30.

[39] Laland, Brown, *Sense and Nonsense*, p. 132.

adaptive, and that certain features which are not adaptations might nonetheless have fortuitous effects, i.e., be adaptive.

Symons argued that the adaptations affecting human behaviour were to be found at the psychological level and thus distinguished between an adaptivist approach which tries to identify adaptive behaviour (which may have no relation with actual adaptations), and an adaptationist approach which searches for these psychological mechanisms that are true adaptations that regulate behaviour. He wrote:

> almost none of the phenomena of interest to social scientists – polyandry, bride wealth, the avunculate, and so forth – are themselves adaptations. Whether or not they are adaptive, they cannot be adaptations, because they are not descriptions of phenotypic design. Darwinism can be applied to social phenomena only insofar as it illuminates the psychological adaptations that underpin these phenomena.[40]

Behavioural ecologists counter these criticisms by maintaining that it is insignificant whether humans behave adaptively because of their psychological mechanisms, learning or culture, as long as the behaviour remains *adaptive,* blurring or outright ignoring the distinction between psychological and behavioural adaptations.

The idea that humans behave optimally is another problem for behavioural ecology. If the data gathered during research do not conform to the theoretical optimal model of behaviour, it is either because the model is faulty and requires revision or because humans do not behave optimally. Behavioural ecologists are reluctant to draw the second conclusion[41] and prefer focusing on adjusting the theoretical model to fit the data gathered. This carries an obvious risk of being endlessly trapped in the process of collecting and comparing data, without ever

[40] D. Symons, "Adaptiveness and Adaptation," *Ethology and Sociobiology* 11 (1990), p. 435.
[41] Laland, Brown, *Sense and Nonsense*, p. 145.

reaching the conclusion of maladaptability. Symons recognizes and draws attention to a potential threat in such a model of research:

> To the adaptivist data like these [i.e. evidence of suboptimal behaviour] are a theoretical challenge; the typical adaptivist's response to such a challenge is to cast about some *ad hoc* reason why apparently maladaptive behaviour might conceivably be more adaptive than it seems.[42]

Symons' criticisms of behavioural ecology gave rise to a different tradition in evolutionary studies. Symons, together with Leda Cosmides and John Tooby, are the chief proponents of this approach, which is focused mainly on the evolved psychological mechanisms which constitute the basis for human behaviour. They labelled this approach *Darwinian psychology* or *evolutionary psychology* and highlighted its disparity with behavioural ecology:

> [m]any researchers have made a conceptual 'wrong turn', leaving a gap in the evolutionary approach that has limited its effectiveness. This wrong turn has consisted of attempting to apply evolutionary theory directly to the level of manifest behavior, rather than using it as a heuristic guide for the discovery of innate psychological mechanisms.[43]

Cosmides and Tooby firmly claim that "natural selection cannot select for behavior per se; it can only select for mechanisms that produce behaviour."[44] David Buss illustrates this precept with jealousy as an example: a male experiencing this emotion at the sight of their partner interacting friendly with another male might have a selective advantage over those that would remain passive in a similar situation. However, the choice of particular behaviour in this situation would depend on a variety of factors and would be highly context-dependent, making any predictions as to the actual behaviour very difficult. Evolutionary psychologist do nonetheless

---

[42] Symons, "Adaptiveness and Adaptation," p. 433.

[43] L. Cosmides, J. Tooby, "From evolution to behavior: evolutionary psychology as the missing link" in: *The Latest on the Best: Essays on Evolution and Optimality*. Ed. J. Dupré, (Cambridge MA: MIT Press, 1987), p. 278-279.

[44] Cosmides, Tooby, "From Evolution to Behavior," p. 281.

confidently expect the experience of jealousy to be reliably predictable, thus constituting a psychological mechanism.[45]

According to evolutionary psychologists, these cognitive mechanisms, which are complex adaptations, evolved slowly in an ancestral environment vastly different from the modern one. John Bowlby's term of "the Environment of Evolutionary Adaptedness" was adopted to refer to this past selective environment:

> The recognition that adaptive specializations have been shaped by the statistical features of ancestral environments is especially important in the study of human behaviour. Human psychological mechanisms should be adapted to those environments, not necessarily to the twentieth century industrialized world.[46]

Two conclusions follow from such a concept of the EEA. Firstly, by establishing which types of problems might have been encountered by human ancestors in the EEA it may be possible to deduce which mechanisms evolved to cope with these problems.[47] Secondly, there exists a possibility of adaptation lag: if the psychological mechanisms evolved over an extended period of time during the Pleistocene, then the relatively recent post-Paleolithic changes in the human environment would have occurred too fast for significant evolution of these mechanisms to have taken place. Thus, some of the responses triggered by these mechanisms might be maladaptive.

A key assumption of evolutionary psychology is that the evolved psychological mechanisms are highly specialised or domain specific. Buss argues that it is so because:

> (1) general solutions fail to guide the organism to the correct adaptive solutions; (2) even if they do work, general solutions lead to too many errors and thus are costly to the organism and (3) what

---

[45] David Buss, *The Evolution of Desire: Strategies of Human Mating* (New York: HarperCollins, 1994), p. 125-129.

[46] Cosmides, Tooby, "From Evolution to Behavior," p. 280-281.

[47] Smith, "From Evolution to Behavior," p. 28.

> constitutes a 'successful solution' differs from problem to problem.[48]

Thus, in order to cope with a large number of complex problems, the human mind must have a massively modular structure, i.e., it must be composed of hundreds of specialised mechanisms responsible for domains as diverse as mating, friendship, predator avoidance, social exchange and sexual behaviour.[49]

All the tenets of evolutionary psychology are subject to criticisms. According to Robert Foley, the concept of the EEA "raises a number of questions about the specificity of what exactly it is or was."[50] There is a recognised tendency among evolutionary psychologists to stereotype the EEA as African Pleistocene savannah,[51] but Foley argues that it is necessary to acknowledge that the human hunter-gatherer ancestors lived in a much wider range of environments and displayed a large variation in behaviour. Foley argues that

> [m]uch of the variability among hunter-gatherers is regional, and both cultural and environmental factors are at play. It is clear that there are major ecologically driven differences for example between arctic Inuit and desert-dwelling San […] It is also the case, however, that marked differences exist between hunter-gatherers in similar environments but in different geographical regions.[52]

In order for an exhaustive evolutionary analysis to take place, it would be necessary (although nigh impossible) to recreate the conditions of the EEA taking all the variables into account.

---

[48] David Buss, Evolutionary Psychology: The New Science of the Mind (London: Allyn and Bacon, 1999), p. 52.

[49] Laland, Brown, *Sense and Nonsense*, p. 162.

[50] R. Foley, "The adaptive legacy of human evolution: a search for the environment of evolutionary adaptedness,"*Evolutionary Anthropology* 4 (1996), p. 195. .

[51] M. Wilson, M. Daly, "Human Evolutionary Psychology and Animal Behaviour," *Animal Behaviour* 57 (1999), .

[52] Foley, "The adaptive legacy of human evolution," p. 195.

Instead, what Foley proposes, with some support from Cosmides and Tooby[53], is that the EEA be conceived of as a general notion of past human environment, "a shorthand for the human evolutionary heritage."[54] Rather than being a set and defined time and place, the EEA is a general concept of the past, since many evolutionary problems remain constant regardless of their environment and humans must therefore show some adaptation to them.

Laland and Brown draw attention to another problem with the EEA: present-day humans cannot be adapted exclusively to past environments. Human natural selection has not stopped, therefore individuals must also exhibit at least partial adaptation to the present conditions.[55] Moreover, there is disagreement as to the time necessary for natural selection to have taken place. While it is generally assumed that the complex adaptations necessary for the human brain to evolve to its present form must have taken a long time, there is evidence that biological evolution can be much faster. Research by Kingsolver et al. suggests, however, that natural selection can cause significant adaptive modifications in an organism in as little as a hundred generations.[56]

Criticisms are also directed at the idea of domain-specificity of psychological mechanisms. While there are benefits from evolved domain-specific mechanisms, it is inconceivable that the mind would be able to develop a mechanism for every possible situation or problem. Too much specificity would simply be too costly to maintain and hence detrimental to performance. Domain general-processes would be

---

[53] J. Tooby, L. Cosmides, "The past explains the present: Emotional adaptations and the structure of ancestral environments," *Ethology and Sociobiology*, 11 (1990), p. 386-7.

[54] Foley, "The adaptive legacy of human evolution," p. 196.

[55] Laland, Brown, *Sense and Nonsense*, p. 181.

[56] cf. J. Kingsolver et al., "The strength of phenotypic selection in natural populations," *American Naturalist* 157, 2001, p. 245–61.

selected in cases where they "make a good enough job at low cost."[57] From these reservations follows the conclusion that at least some mental processes are domain-general, although the domain-specific remains dominant within evolutionary psychology.[58]

Yet another serious criticism of evolutionary psychology focuses on the extreme adaptationism of evolutionary psychologists. A model of evolution based solely on natural selection is largely outdated. There is a growing recognition that many traits are not adaptations and are instead exaptations (that is characters which now enhance fitness, but were not developed for their current role through natural selection), side-effects of adaptations, or are the result of genetic drift, i.e., random genetic changes. Natural selection itself is also increasingly recognised to be much more complex than previously thought. Laland and Brown quote Endler's claim that there are 21 processes involved in natural selection, some of which operate below the level of an individual organism, and some of which operate above that level.[59]

None of these criticisms appears to definitely undermine the scope and ambitions of evolutionary psychology. Rather, they facilitate the understanding of complexities involved in evolutionary research. Yet, it is clear that evolutionary psychology needs to refine its understanding of evolutionary processes, and needs to develop more rigorous techniques for testing its hypotheses. While the overall tone of evolutionary psychology research remains optimistic and even enthusiastic, and while it has already provided illuminating insights into the nature of the human mind, it has to be recognised that evolutionary psychology has shown significant neglect

[57] Laland, Brown, *Sense and Nonsense*, p. 183.
[58] cf. Buss, *Evolutionary Psychology*.
[59] Laland, Brown, *Sense and Nonsense*, p. 187-188.

for the role of cultural processes involved in the shaping of human selective environment.[60]

The cultural processes became, however, the object of interest of Richard Dawkins, who, in the final chapter of *The Selfish Gene*, introduced an intriguing idea. Dawkins suggested that cultural phenomena – fashions, fads and trends, but also language, art and technology – evolve over time by means of replicators, which are of similar nature to genes. Dawkins wrote:

> We need a name for the new replicator, a noun that conveys the idea of a unit of cultural transmission, or a unit of imitation. "Mimeme" comes from a suitable Greek root, but I want a monosyllable that sounds a bit like 'gene'. I hope my classicist friends will forgive me if I abbreviate mimeme to 'meme.'[61]

Dawkins considers memes to be units of information or ideas and suggests that they posses all the features necessary for evolution, and the qualities of good replicators: variation, heredity and differential fitness as well as longevity and the ability to be copied effectively with some degree of accuracy. From drawing the parallels between genes and memes follows the assumption of the meme's-eye view, that is analysing cultural phenomena from the point of view of the meme in order to understand how and why they evolved. Again, in parallel with the gene, Dawkins proposed that if genes "are active agents, working purposefully for their own survival, perhaps it might be convenient to think of memes in the same way."[62]

He further suggested that it is not humans who pick their memes, but to the contrary, it is the memes which choose humans as hosts and influence their behaviour to their own ends. According to Dawkins "a cultural trait may have evolved in the way it has simply because it is *advantageous* to itself"[63] and it need

---

[60] Baxter, *A Darwinian Worldview*, p. 47.
[61] Richard Dawkins, *The Selfish Gene* (Oxford: Oxfprd University Press, 1976), p. 206.
[62] Dawkins, *The Selfish Gene*, p. 202.
[63] Dawkins, *The Selfish Gene*, p. 214.

not have an obvious beneficial influence on human fitness. Indeed some memes may have a negative influence: it is highly unlikely that a gene for celibacy would be selected for, but if a meme of celibacy increased a priests ability to influence their followers, and hence aid in the spread of related memes (i.e., religion) it would be likely to be selected for.

Dawkins proposed that "memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation."[64] Laland and Brown expand upon this description and suggest that there are three distinct forms of meme transition and acquisition: copying the process (reproducing a behaviour), copying the product (reverse-engineering the informational content of the meme) and copying the instructions (utilising a syntactic description of the meme).[65] A major problem in meme transmission is fidelity. Cultural transmission involves an immense amount of variation, recombination and flexibility and hence it may be questionable to think of memes as effective replicators. Here, Laland and Brown claim that despite being variable between individuals, all memes possess "a core element that is shared knowledge"[66] and, they add, it is natural for this core element to change over time. Dan Sperber, in turn, argued against meme transmission and instead put forward a hypothesis that memes are reconstructed independently by individuals. The appearance of the same meme in different individuals can then be attributed to the incorporation of evolved psychological mechanisms in the recreation of the meme (i.e., a similar brain structure). [67]

---

[64] Dawkins, *The Selfish Gene*, p. 206.

[65] Laland, Brown, *Sense and Nonsense*, p. 208.

[66] Laland, Brown, *Sense and Nonsense*, p. 214.

[67] cf. D. Sperber, "An objection to the memetic approach to culture" in: *Darwinizing Culture: the Status of Memetics as a Science*, ed. R. Augner (Oxford: Oxford University Press), p. 163–73.

The memetic approach to culture, quite predictably, was met with a number of critcism. One of the more easily shrugged off is that is considerably difficult to define the boundaries of a meme. Seemingly, in comparison with the clear-cut gene, the meme idea appears to be somewhat hazy. Laland and Brown counter this allegation by arguing that the gene is not a well defined concept either, that there exist varying definitions of it and even disagreements among biologists as to what constitutes a species, and yet these have not prevented progress in evolutionary biology. In a surprisingly blunt and shockingly inadequate conclusion, Laland and Brown advise memeticists to "get on with it."[68]

Another criticism, and an apparent problem with memes, concerns their lineage. Stephen Gould argues that "[b]iological evolution is a system of constant divergence without subsequent joining of branches. Lineages, once distinct, are separate forever. In human history, transmission across lineages is, perhaps, the major source of cultural change,"[69] thus stressing the disparity between the cultural and biological processes, which might undermine the central axiom of memetics. Laland and Brown yet again counter this allegation by invoking cases when two biological species have actually merged together or entered into symbiotic relations, both situations serving as examples of phenomena in which genetical lineages come into horizontal contact and repeatedly merge and split. Laland and Brown argue that since tracing down genetical lineages is nonetheless possible for geneticists, so it will be possible for memeticists, despite the increased speed with which memes evolve.

The biggest reservation to memetics is that it has not reached science status yet. The speed with which memes mutate and our disability to read them within the

---

[68] Laland, Brown, *Sense and Nonsense*, p. 225-226.

[69] Stephen J. Gould, *Bully for Brontosaurus. Reflections in Natural History*. (New York: Norton & Co.,1991) p. 65.

brain constitute important obstacles in empirical memetic research. Simply, there is no established rigorous methodology for doing memetics,[70] even though certain methods are proposed and promising research is being conducted. Laland and Brown tentatively suggest a set of methods appropriated from Endler's experimental means of detecting natural selection,[71] while Hull proposes that the study of the mechanisms of memetic transmission might be a valid starting point for the science:

> Memeticists cannot begin to understand what the science of memetics is until they generate general beliefs about conceptual changes and try to test them. These tests are likely to look fairly paltry, but in the early stages of a science, attempts at testing always look paltry.[72]

With all the reservations taken into account, memetics still offers a potentially useful tool in quantitative analysis of cultural processes. Even if it does not provide us with a holistic and comprehensive theory of human nature, memetic research, if conducted rigorously, might bring insights into the causes, patterns and rates of cultural evolution. As of the present, however, memetics remains an unrealised theoretical possibility, and the apparent lack of results seems to be causing a waning of interest in it.

A more integrated approach was developed to account for the interactions between biological and cultural evolution. Called the *Dual Inheritance Theory* or *Gene-Culture Coevolution,* this approach is a functional cross between evolutionary psychology and memetics. The foundations for the theory of gene-culture coevolution were laid out independently by Edward Wilson and Charles Lamsden in *Genes, Mind and Culture*, and Luca Cavalli-Sforza and Marcus Feldman in *Cultural Transmission and Evolution*, both published in 1981. Lumsden and Wilson describe

---

[70] Laland brown, *Sense and Nonsense,* p. 233. .

[71] cf. Joseph Endler, *Natural Selection in the Wild* (Princeton, NJ: Princeton University Press, 1986).

[72] D. Hull,"Taking Memetics Seriously: Memetics Will be What We Make It" in: *Darwinizing Culture: the Status of Memetics as a Science,* ed. R. Augner (Oxford: Oxford University Press, 2000), p. 49.

gene-culture coevolution as "a complicated, fascinating interaction in which culture is generated and shaped by biological imperatives while biological traits are simultaneously altered by genetic evolution in response to cultural innovation."[73]

Like memetics, gene-culture coevolution assumes that culture displays the characteristics necessary for evolution (inheritance, variability, fitness effects) and thus is subject to processes of cultural selection. Gene-culture coevolutionists consider culture to be a pool of ideas, beliefs and values which are learned and transmitted between individuals. Like evolutionary psychology, gene-culture coevolution assumes that the cultural knowledge an individual adopts may depend on their genetic constitution (although it does not necessarily *have to*). These gene-culture dependencies are reciprocal: cultural choices may cause selective pressures which will in turn influence the genes.[74] Gene-culture coevolution thus provides a pluralistic explanation of human behaviour and stresses its codetermination by a variety of environmental, genetic and cultural factors.[75]

The feature that distinguishes gene-culture coevolution from other approaches is its recognition of and interest in non-adaptive or maladaptive results of evolutionary processes. Cavalli-Sforza and Feldman introduce the concept of cultural selection, i.e., a process by which a particular piece of cultural information increases or decreases in frequency (is either adopted or rejected). According to them, cultural selection can work against natural selection: fertility control is a popular choice in developed countries, yet it is a clear disadvantage in terms of

---

[73] C. Lumsden, E. Wilson, *Genes, Mind and Culture: The Coevolutionary Process* (Cambridge, MA: Harvard University Press, 1981), p. 1.

[74] Laland, Brown, *Sense and Nonsense*, p. 242-243.

[75] Smith, "Three Styles in the Evolutionary Analysis of Human Behavior," p. 32.

natural selection as it leads to fewer offspring. Genetic fitness decreases due to the high cultural fitness of the idea of contraception.[76]

If cultural information is altered before it is passed on, cultural traditions will change. Boyd and Richerson in *Culture and the Evolutionary Process* (1985) give account of how cultural information can be changed. They differentiate between guided variation, that is a process by which individuals acquire knowledge of a behaviour from others and then modify this behaviour according to their personal experience, and various types of biased cultural transmission. Direct bias refers to a genetic predisposition to favour certain information; frequency-dependent bias refers to a situation in which the observed frequency or rarity of a behaviour influences its adoption (with the obvious conclusion that the more common the behaviour the more often it is adopted); finally, in the case of indirect bias, individuals use cues about a trait (e.g., wealth) to choose which individuals to observe in order to obtain information about another trait (e.g., fashion).[77]

William Durham identifies five categories of gene-culture interaction responsible for the variations in human behaviour and society: g*enetic mediation*, in which cultural variation is caused by genetic differences; *cultural mediation*, in which it is the cultural change which causes genetic change; *enhancement*, in which cultural behaviour reinforces genetic predispositions; *neutrality*, in which cultural variations are adopted independently of genetic predispositions and finally *opposition*, in which culture leads to maladaptive behaviours.[78]

A serious obstacle to a wider adoption of gene-culture coevolution perspective is the complexity of mathematical models necessary for performing

---

[76] Laland, Brown, *Sense and Nonsense*, p. 251.

[77] Laland, Brown, *Sense and Nonsense*, p. 252.

[78] cf. W. Durham, *Coevolution: Genes, Culture and Human Diversity* (Stanford: Stanford University Press, 1991).

analyses and constructing theoretical descriptive models of the interconnected cultural and genetic processes and calculating the probabilities of adopting particular traits.[79] A serious obstacle to doing so is the difficulty in dividing culture into discrete units. The concept of the meme, or Lumsden's and Wilson's idea of a "culturgene," almost synonymous with meme, might prove helpful here, and Laland and Brown insist that it is possible to identify distinct elements of culture, thus opening the way for their advanced analysis.[80]

However, with the recognition that biological evolution might be faster than previously expected and with the necessary recognition that some cultural phenomena remain relatively stable over long periods of time, the apparent speed discrepancy between cultural and genetic evolution disappears. This opens a realistic opportunity for empirical study of gene-culture coevolution, although the potential remains unrealised.

Scientific Consilience

With a growing body of knowledge made available in the aftermath of a debate he himself started, and with a growing conviction of the validity of the evolutionary paradigm, E. O. Wilson put forward the claim that the natural sciences have become largely consilient[81] and that the social sciences must (or will) become consilient with them too. Consilience means that sciences form an explanatory hierarchy – biological processes are explained through chemistry which is explained through physics – and that theories of sciences at the higher levels of that hierarchy must be

[79] Laland, Brown, *Sense and Nonsense*, p. 253-258.
[80] Laland, Brown, *Sense and Nonsense*, p. 273-274.
[81] Edward O. Wilson, *Consilience: The Unity of Knowledge* (London: Little, Brown and Co., 1998), p. 9.

compatible with the laws of lower levels. If they are not, a revision is necessary. Since biology and psychology are already becoming consilient,[82] by necessity the social sciences and the humanities will have to follow suit in order to make their contributions relevant and useful.

Wilson claimed that within social sciences there are no efforts to link and connect the various disciplines and that these disciplines exist separately, divided and without any unifying concepts.[83] He attributed these divisions to the social scientists' rejection of the hierarchical vision of science. Understandably, the social sciences could not achieve consilience with the natural sciences as there is no (or little) place allowed within social sciences for biological forces of the kind proposed by sociobiology, and thus no attempts were made to trace causal patterns across the biological and social domains.[84] Wilson proposed that in order to provide accurate descriptions of cultural or political activities, social scientists should move from the genetic level, to brain science, to psychology and only then to social study. Such a wide analysis would endow social scientists with more knowledge about why humans act and behave the way they do, and would provide a stable ground for research more oriented to solving problems than idle theoretical disputes over terminology.

Wilson's case is compelling. The natural sciences do interconnect more and more. The host of sociobiological approaches develops more accurate methods for their analyses and brings promising results. In advocating their larger adoption by the social sciences, Wilson presents an extremely tempting "prospect of intellectual

[82] cf. Wilson, C*onsilience*, p. 137 – 180.
[83] Wilson, *Consilience*, p. 201.
[84] Wilson, C*onsilience*, p. 208-209.

adventure"[85] reminiscent of the sense of marvel that must have accompanied the Enlightenment pioneers of modern science in their endeavours (underlined by his frequent references to de Condorcet). The necessity for interdisciplinary cooperation at all levels, from institutional to personal, arising from the very complexity of the subject matter, might facilitate the bridging of the gap between the social and natural scientific cultures. Ultimately, Wilson's scientific consilience might lead to "understanding the human condition with a higher degree of certainty,"[86] a goal as of yet unattained by either the social sciences or the humanities.

Conclusion

Consilience is not a blind attempt to reduce the study of very complex human phenomena to biochemical, cellular processes or indeed all science to the level of particle physics. As Henry Plotkin argues, studying the fundamental levels of phenomena allows for their most comprehensive understanding, but not all levels of fundamentality are equal: complex structures often have multiple levels of causative mechanisms, and for practical (and institutional) reasons scientists work to provide explanations of the world at the levels fundamental to their respective disciplines.[87] Consilience is an organising principle, according to which these explanations should not contradict each other.

What this means for the humanities, and the humanist, is that the analyses of social and cultural phenomena cannot contradict the findings of human life sciences, in which the evolutionary paradigm reigns supreme. What it means for literary

[85] Wilson, C*onsilience*, p. 7.
[86] Wilson, C*onsilience*, p. 7.
[87] Henry Plotkin, *Evolutionary Worlds Without End* (Oxford: Oxford University Press, 2010), p. 3-5.

studies, is the necessity of an emergence of a theoretical paradigm aligned with the evolutionary one.

CHAPTER 2: DARWINIAN LITERARY STUDIES AND THE ROLE OF SCIENCE FICTION

> Walt was a real person and no doubt that was why NASA had selected him. His genes – they were probably stuffed to overflowing with four thousand years of culture, the heritage of mankind built right in.
>
> Philip K. Dick, *Dr. Bloodmoney*

The appropriation of the evolutionarily oriented thought into a meta-narration for a critical and theoretical paradigm proceeds through the rejection of the post-modern, non-consilient, epistemology and the literary-theoretical paradigm arising from it, in favour of an epistemology based on and derived from biological premises, which, for contrast, is referred to as either bioepistemology or evolutionary epistemology.

The first two sections of this chapter outline the arguments on which the rejection is based and present the bioepistemological alternative, while the following three sections discuss the potential adaptive functions of, respectively, art, fiction and science fiction.

Against Theory

In *The Postmodern Turn*, an attempt to outline the scope and depth of the paradigmatic shift, Best and Kellner enumerate four core features of the postmodern: the rejection of "unifying, totalizing, and universal schemes in favour of new emphases on difference, plurality, fragmentation and complexity"[88] or in Lyotard's terms, the rejection of meta-narratives in favour of local narratives; the rejection of "closed structure, fixed meaning and rigid order in favour of play, indeterminacy,

[88] Steven Best, Douglas Kellner, *The Postmodern Turn* (New York: Guilford Press, 1997), p. 255.

incompleteness, uncertainty, ambiguity, contingency and chaos,"[89] which Best and Kellner illustrate with postructuralist theories of linguistic indeterminacy; the rejection of "naive realism and epistemology, as well as unmediated objectivity and truth in favour of perspectivism, anti-foundationalism, hermeneutics, intertextuality, simulation and relativism"[90] and, lastly, an emphasis on "deconstructing boundaries within and among different disciplines,"[91] quoting Derrida's attack on the distinction of philosophy and literature, postmodern fiction's blurring of the boundaries between fiction and history and pop art's blurring the boundaries between art and everyday life as examples.

It is obvious from the preceding discussion that broad interdisciplinarity is at the core of Wilson idea of scientific consilience. What is the object of Darwinist criticism, however, is the particular form of interdisciplinarity practised and celebrated by certain postructuralist thinkers. Richard Levin's article "The New Interdisciplinarity in Literary Criticism" published in *After Postructuralism: Interdisciplinarity and Literary Theory*, draws attention to its problematic character. Levin uses a number of examples of Freudian and Marxist critics to illustrate how a theory from a given discipline is chosen as an analytical tool for another discipline not on the basis of its correctness but on the basis of its usefulness for the critic. The two most striking examples he quotes are of Jean Kennard use of Joseph Zinker's psychological theory because she is "comfortable with it" and of Catherine Belsey's turning to Freudian psychoanalysis because of its potential to challenge the "existing order" and to undermine "the unitary subject of bourgeois ideology" with

[89] Best, Kellner, *The Postmodern Turn*, p. 256.
[90] Best, Kellner, *The Postmodern Turn*, p. 257.
[91] Best, Kellner, *The Postmodern Turn*, p. 258.

pronounced disregard to the criteria of truth and correctness of the theory.[92] A theory selected on the basis of its utility will always work as an interpretative tool. As Levin writes "no failure has ever been recorded."[93] He illustrates this point by the Freudian analyses of Shakespeare's plays which presuppose that a hero must have problems with mothering. Levin quotes an impressive list of critics who would find mother-figures in female, male and even non-human characters of the plays. The focus on the presence of the mother is perhaps brought to an absurd level by Coppelia Kahn's insistence that "the mother's absence is evidence for her presence"[94], a claim which renders the theory unfalsifiable. It retains its political value but can no longer be considered scientific. Levin's bitter theses are echoed by Dylan Evans' remark on the popularity of Lacanian psychology in literary criticism. Evans, himself a psychologist, argues that despite Lacan's apparent small significance for clinical psychoanalysis his popularity among literary scholars stems from the political usefulness of his theory.[95]

Similar objections were raised by Brian Boyd, quite possibly the most vocal critic of the post-structuralist paradigm among the literary Darwinists. In his 2006 paper "Theory is Dead – Like a Zombie," he delivers an emblematic critique of the theoretical paradigm. Boyd locates the reason for the enthusiastic embrace of the post-structuralist position in the political and ideological motivations of thinkers and researchers lured in by the seemingly liberating potential of Theory and argues that "[t]he liberationist rhetoric of Derrida, Barthes and Foucault in the late 1960s helped

---

[92] Richard Levin, "The New Interdisciplinarity in Literary Criticism," in: *After Poststructuralism: Interdisciplinarity and Literary Criticism*, eds. Nancy Easterlin and Barbara Riebling (Evanston: Northwestern University Press, 1993), p. 16-17.

[93] Levin, "The New Interdisciplinarity," p. 19.

[94] Levin, "The New Interdisciplinarity," p. 20.

[95] Dylan Evans, "From Lacan to Darwin," in: *The Literary Animal. Evolution and the Nature of the Narrative*, eds. Jonathan Gottschall and David Sloan Wilson (Evanston: Northwestern University Press, 2005).

create a sense of intoxicating avant-gardism, as if they were shaking the foundations of Western thought and power, and stirring the hope that merely by questioning conventions and reversing hierarchies the whole social system could be transformed."[96] One unfortunate consequence of this enthusiastic attack on hierarchies and traditional systems of values is the assumption of a decidedly anti-positivist *a priori* mode of thinking and writing, resulting in a certain devaluation of evidence and the neglect of counter-evidence and a preference for the readings and theories which are more politically appealing rather than scientifically verified. Boyd comments with a particular bitterness: "not that Derrida and Barthes were interested so much in getting things right as in appearing challenging, shocking, revolutionary," mirroring objections raised by Levin about the practice of critics choosing "whatever suits their taste, which turns out to be whatever is useful for their political or critical projects"[97] as a theoretical analytic tool with utter disregard as to the actual correctness of the method chosen.

The end result is a creation of an essentially closed hegemonic system, ruled by obscure jargon[98] and legitimising itself – paradoxically, given its professed anti-authoritarian streak – by reverent references to the authority of a small number of leading figures:

> The practice of Theory has contradicted its central tenets so blatantly for so long that the contradictions would be comic were they not tragic. Although Theorists declare meaning to be indeterminate, endlessly unresolvable, they expected the precise meaning of such claims to be readily understood. When others took issue with their works, they insisted on their own meanings, although their insistence that authors' intentions have no particular value should have ruled out such proceedings. They rejected the transparency of or even the appeal to evidence, except for evidence

[96] Brian Boyd, "Theory Is Dead – Like a Zombie," *Philosophy and Literature* 30.1 (2006), pp. 289-298.

[97] Levin, "The New Interdiscplinarity," p. 17.

[98] See: D.G. Miller, "Bad Writing" in: *Theory's Empire*, eds. D. Patai, W. Corral (New York: Columbia University Press, 2005), pp. 354-360.

> they wished to advance (especially striking in the appeal to evidence in the attempted defense of Paul de Man for his wartime anti-Semitic writings). Theory's allure [...] was largely in its anti-authoritarian stance, but the appeal to authority ("as Foucault has shown") has been as requisite within Theory as invocations of Lenin within Soviet scholarship, and has led to an academic star system in the humanities that elevated individuals and constellated them as authorities to a hitherto unprecedented degree. Theory's proclamations of radical uncertainty have been issued and repeated with rare certainty, with a meaning and a truth value confidently ascribed to the authoritative and authorizing author, so long as that author was, say, a Derrida, a Barthes or a Lyotard. The insistence on the primacy of Theory, in short, has been made through a deeply untheoretical appeal to authority, even to authorities whose ideas conflict with one another—or with themselves, as in the widespread claim that all ideas are merely local, except, apparently, *this* universal "truth" or many another "always" or "always already," like Frederic Jameson's "Always historicize."[99]

The Darwinists are not the first to raise these powerful, and often-times correct objections. Rather, they draw on the heritage of the Science Wars (which, it has to be noted, were themselves, to a degree, influenced by the conflict over sociobiology) and clamor for a continuation (or a rematch), arguing that the sense of intellectual bankruptcy, an academic *malaise* which stems from the recognition of Theory's trappings, is sufficient proof that a revolution in the humanities is needed and necessary and that it should reach further and deeper than a mere tightening of intellectual discipline and closer adherence to textual proof. Whether the situation of literary theory is as dire as Boyd makes it out to be is far beyond the scope of this dissertation, although an intuitive answer of "probably not" would likely be correct.

[99] Boyd, "Theory Is Dead," p. 293.

The Darwinian Paradigm for Culture and Literary Studies

In "Making Knowledge: Bioepistemology and the Foundations of Literary Theory," Nancy Easterlin identifies the preference for "strong constructivism," i.e., the view that knowledge is *made up* rather than *made* to be a common denominator between the host of contemporary literary theories. She links this preference with a sceptical epistemology which denies the possibility of truth and knowledge and underlies approaches as seemingly diverse as neopragmatism, deconstructionism or New Historicism. Easterlin points to a practical consequence of this sceptical position: "while motivated by a moral desire for liberal or radical social change, its underlying epistemology tells us that we cannot know anything, which would include the ability to discriminate between better or worse social conditions and to take remedial action."[100]

In contrast, Easterlin proposes a shift towards bioepistemology, which is based on the central assumption that

> given evolutionary theory as the most plausible account of human origins, the human mind as a result of natural selection is predisposed in ways that have proven adaptively advantageous; from this central premise it follows that questions regarding the nature of human knowledge can be answered through an understanding of certain predispositions (e.g., cognitive adaptations). Accordingly, the conceptual tendencies which enabled primitive man to overcome complexity and act in the interests of survival have direct bearing on the construction of knowledge within human culture.[101]

The view is grounded in the propositions of Karl Popper, claiming that "[l]ife is problem solving and discovery"[102] and of Konrad Lorenz, insisting that "all human

---

[100] Nancy Easterlin, "Making Knowledge: Bioepistemology and the Foundations of Literary Theory," in: *Theory's Empire*, eds. D. Patai, W. Corral (New York: Columbia University Press, 2005), pp. 624.

[101] Easterlin, "Making Knowledge," pp. 625-626.

[102] Karl Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford, Oxford University Press, 1979), p. 148.

knowledge derives from a process of interaction between man as a physical entity, an active, perceiving subject, and the realities of an equally physical external world, the object of man's perception."[103] Thus, humans are able to "acquire relevant information about the world and to use this information for their survival."[104] From this perspective meaning and knowledge are produced by physiological structures (such as the sense organs) rather than by cultural and linguistic codes, and their existence is not only possible and desirable but biologically necessary. The continuous survival and the apparent successes of the *homo sapiens*, the billions of successful daily communicative situations, the transmission of vast amounts of information and the coordination of powerful social efforts all serve as ubiquitous empirical evidence of the position's correctness.

In her article Easterlin further voices the amusement at the fact that "[i]n light of the denial of human agency which has become commonplace in literary theory […] it is nothing short of miraculous that a field devoted to studying the artifacts of *human* culture has survived at all"[105] and adds that "to be meaningful, discussion of the artifacts of human culture must be framed by our knowledge of human beings, not by artificial or incomplete notions of our world and our social experience."[106]

Needless to say, a school of critical theory derived from such premises, based on sharp distinction between the subject and the object and the rejection of the primacy of language and linguistic constructivism *has to* conflict with the currently dominant critical perspectives. The Darwinist diagnosis of the state of literary theory proceeds from the recognition that the central claims of the primacy of language and

[103] Konrad Lorenz, *Behind the Mirror,* Trans. Ronald Taylor (New York: Harcourt Brace Yovanovich, 1979), p. 1 .
[104] Lorenz, *Behind the Mirror*, p. 6.
[105] Easterlin,"Making Knowledge," p. 625.
[106] Easterlin, "Making Knowledge," p. 625.

hence the conventional, arbitrary and discursive character of all knowledge, meaning, the symbolic systems of values and ideologies, and ultimately human nature itself, are simply incorrect, because they neglect and ignore the existence of the innate, biological conditionings and their influence on the shaping of human culture. Thus, Joseph Carroll, a leading proponent of the Darwinian critical paradigm, states with certainty:

> If a theory of culture and literature is true, it can be assimilated to the Darwinian paradigm; and if it cannot be reconciled with the Darwinian paradigm, it is not true. The poststructuralist explanation of things cannot be reconciled with the Darwinian paradigm. It cannot merely be modified and assimilated to the Darwinian paradigm. It is an alternative, competing paradigm. It operates on principles that are wholly different and fundamentally incompatible with those of evolutionary theory. It should, consequently, be rejected.[107]

It is of note, however, that the literary Darwinists do not merely argue against psychoanalytical criticism and in favour of an evolutionary psychological one. Carroll's quote contains a much farther-reaching mission statement which involves a summary rejection of all contemporary theory rather than any of its claims in particular. Carroll, indeed, speaks of a paradigmatic revolution in the Kuhnian sense of supplanting an inadequate paradigm with a more accurate one; to achieve that goal the literary Darwinists

> rally to Edward O. Wilson's cry for "consilience" among all the branches of learning. Like Wilson, they envision an integrated body of knowledge extending in an unbroken chain of material causation from the lowest level of subatomic particles to the highest levels of cultural imagination. And like Wilson, they regard evolutionary biology as the pivotal discipline uniting the hard sciences with the social sciences and the humanities. They believe that humans have evolved in an adaptive relation to their environment. They argue that for humans, as for all other species, evolution has shaped the anatomical, physiological, and neurological characteristics of the species, and they think that human behavior, feeling, and thought are fundamentally

[107] Joseph Carroll, "Poststructuralism, Cultural Constructivism and Evolutionary Biology," *Symploke* Vol.4, Nos. 1-2 (1996), pp. 203-219.

> constrained and informed by those characteristics. They make it their business to consult evolutionary biology and evolutionary social science in order to determine what those characteristics are, and they bring that information to bear on their understanding of the human imagination.[108]

This theoretical reorientation aims at bringing "literature itself within the field of cognitive and behavioural features susceptible to an adaptationist understanding."[109] Proceeding from the recognition of the biologically and evolutionarily constrained human nature as a source and subject of literature, the Darwinist critics seek to understand the structures, functions and forms of literature. The turn to the findings of evolutionary psychology leads to the creation of a theoretical feedback loop: studying the evolved mind can increase our knowledge of literature, and at the same time studying literature can improve our understanding of the evolved mind, a premise not dissimilar to that guiding other schools of psychology-oriented criticism, seeking to "build a foundation for literary studies in a systematic […] psychology."[110]

In the most general terms the object of Darwinian Literary Studies is to employ adaptationist thinking to "understand what literature is, what its functions are, and how it works – what it represent, what causes people to produce it and consume it, and why it takes the form it does."[111] Carroll identifies six major and sometimes overlapping components of the field: general programmatic manifestos, commentaries on the relation between it and the neighbouring fields of ecocriticism and cognitive rhetoric, discussions about the adaptive function of literature, discussions on topics of literary theory, critiques of specific works and broad studies

---

[108] Joseph Carroll, "An Evolutionary Paradigm for Evolutionary Study," *Style*, Vol.42, Nos.2-3 (2008), p. 105.

[109] Joseph Carroll, *Literary Darwinism. Evolution, Human Nature and Literature* (New York: Routledge, 2004), p. vi.

[110] Jonathan Gottschall, "The Tree of Knowledge and Darwinian Literary Study," *Philosophy and Literature*, Volume 27, Number 2, October 2003, p. 259, *Project MUSE*.Web.(10 Dec, 2011).

[111] Carroll, *Literary Darwinism,* p. vi .

employing empirical and statistical methods, admitting that only the first category seems to be sufficiently developed.[112]

Nonetheless, the results of literary research conducted along the lines drawn by Carroll are certainly intriguing and while it would be counter-productive to present them here in bulk, a few notable examples should be mentioned if only for illustrative purposes. The first book-length example is Brett Cooke's 2002 *Human Nature in utopia: Zamyatin's* We in which Cooke delineates the features of human nature, using evolutionary psychology as the basis, and proceeds to show how these are violated in the dystopian narrative. Jonathan Gottschall's *The Rape of Troy: Evolution, Violence and the World of Homer* (2008) traces the sociobiological conditioning as the motivating forces of Homer's works. The anthology *Literary Animal* (2005) includes, among others, papers by Robin Fox who discusses the evolutionary grounds for the male bonding mechanics presented in epics and by Robin Dunbar who analyses the cast structures of Shakespeare's plays and proceeds to link the limitations of both the cast size and the number of characters on stage at any given moment to his own research on the human cognitive limits of tracing inter-personal interactions.

Interesting though the above-mentioned analyses might be, it is difficult not to agree with Frederick Crews that their "results belong to aesthetics, psychology, and anthropology, but not, as Carroll acknowledges, to literary criticism, because the goal here is data extraction and replicable social-scientific knowledge rather than identification and explanation of the features that set a given work apart from others"[113] and that "[t]he subject matter of literary study is not human nature; it is

---

[112] Joseph Carroll, "Evolutionary Approaches to Literature and Drama" in: *The Oxford Handbook of Evolutionary Psychology*, eds. R. Dunbar, L. Barret (Oxford: Oxford University Press, 2007), p. 644.
[113] Frederick Crews "Apriorism for Empiricists," *Style*, Vol.42, Nos.2-3 (2008), p. 156.

literature."[114] Crews himself is a staunch critic of post-structuralist tendencies and an advocate of a rigorous, disciplined approach to studying texts. He points out the possibility that the seemingly anti-dogmatic and open-ended Darwinian study of literature may fall into precisely the same groove in which textual evidence is chosen and discarded at will, in order to accommodate the results of analysis to *a priori* conclusions, pre-determined by the researcher on the grounds of their loyalty to the Darwinian paradigm. In other words, Crews warns against a seemingly liberating analytical heuristics becoming a closed, jargon-filled and hypocritical hegemony based on and derived from premises different to those of Theory, but ultimately strategically identical with it.

A serious concern has to be raised about the summary rejection of all literary theory which does not explicitly recognise or take into account the evolutionary agenda. As evidenced by Carroll's remarks quoted earlier, the Darwinists tend to assume a "with us or against us" attitude which leads to rewriting much of already-established theoretical principles (such as those concerning the functions of literature, discussed in the subsequent chapter) without acknowledging thinkers and scholars reaching similar conclusions not overtly set within the evolutionary paradigm. It is a serious strategic mistake, because it hinders both the location of Darwinian literary study in a critical context, which unnecessarily complicates research, and excludes the possibility of meaningful critical dialogue, often because of emotional rather than scientific reasons. Of course, dialogue and discussion are not the central objectives of Carroll's and Boyd's paradigmatic manifestos, yet it has to be recognised, that while consilience is not exactly conciliation, a valid critical enterprise should not close itself off in such a militant and often condescending

[114] Crews, "Apriorism for Empiricists," p. 156.

manner, particularly if it is rooted in the criticism of other schools precisely for that very reason.

As pointed out earlier, evolutionary psychology is far from being an uncontroversial branch of knowledge. Recognising its limitations, Darwinian literary critics disassociate from the model of massive modularity and appear to favour a model of human psyche which is much less constrained by the biological ramifications and assumes a more fluent structure of the mind. This view presupposes that the EEA has been an unstable and ecologically diverse habitat in which it would be impossible to rely on domain-specific mechanisms. As the anthropologist William Irons observes "general mechanisms are better at dealing with novelty."[115] What necessarily follows is the recognition of human behavioural flexibility as a result of adaptation to this changing and unstable past environment. Arguing in favour of this approach, Rick Potts writes:

> There appears to have been a succession of evolved mechanisms that amplified the adaptive flexibility of certain hominid taxa over time […] Pliocene locomotor versatility was succeeded in the early Pleistocene by an expansion of dietary possibilities, habitat diversity, and distances of movement. These means of adaptive flexibility were heightened as relative brain size increased during the middle Pleistocene. In still later populations, new means of behavioral flexibility were manifested, including complex symbolic coding, more rapid and spatially diverse technological innovation, and powerfully coordinated social action such as bone architectural feats and long-distance trading. These new possibilities represented an unprecedented degree of behavioral versatility, and were expressed after several hundred thousand years of intense habitat change.[116]

Embracing this position allows Darwinian critics to evade accusation of over-insistence on the modular view of the mind and thus of extreme adaptationism and to account for the seemingly unlimited variety of human behaviours and cultural

---

[115] William Irons, "Adaptively Relevant Environments versus the Environment of Evolutionary Adaptedness, *Evolutionary Anthropology* 6 (1998), p. 198.

[116] Rick Potts, "Variability Selection in Hominid Evolution," *Evolutionary Anthropology* 8 (1998), p. 86.

activity[117] by inscribing them within the context of the evolved behavioural flexibility. [118]

With these reservations in mind, we can observe that what ultimately emerges is a theoretical paradigm in which it is possible to understand humans for what they are: exceptional products of Nature, in many ways inimical to it, and in many ways able to exceed their evolutionary limitations, but in all cases working, acting, thinking, feeling and perceiving with and through the evolved biological apparatus. If not all human behaviour is adaptive, and if not all of it contributes to increasing fitness, all of it is, at certain, sometimes very deep, levels, shaped and influenced by the human evolutionary heritage. The Cartesian dichotomy of mind and body becomes irrelevant. Nature and nurture cease to be oppositions and become complementary. Man is firmly embodied and it is this embodiment which allows to explain how the immaterial, the linguistic, the affective and the ideational arise and are organised.

The Adaptive Function of Art

To do so it is necessary to proceed from the evolutionary attempts at explaining the function of art in general, which fall into two groups: those which consider art to be an adaptation, that is a fitness-enhancing trait developed through sexual or natural selection, and thus showing a clear function as well as a complex design toward performing this function; and those which do not consider art to be an adaptation but rather see it as a product (or a by-product) of the evolved human mind. The ultimate

[117] See Jonathan Kramnick "Against Literary Darwinism," *Critical Enquiry 37* (Winter 2011), pp. 315-347 and Carroll's refutal in: Joseph Carroll, "An Open Letter to Jonathan Kramnick".

[118] See: D.S. Wilson, "Evolutionary Social Constructivism" in: *The Literary Animal*, eds. J. Gottschall, D.S. Wilson (Evanston: Northwestern University Press, 2005), pp. 20-38.

solution to the question is a matter to be settled by evolutionary psychologists and thus it is not genuinely central to the present discussion, however a brief review of those positions is in order.

The earliest (and brief) evolutionary remarks on the origin and function of art come from Charles Darwin and are derived from his theory of sexual selection. Darwin noted that certain ornamental features displayed by males would render individuals more conspicuous and thus less likely to avoid predators, seemingly contradicting the theory of natural selection. In order to account for this apparent aberration, Darwin proposed that the ornaments would serve to increase the male's attractiveness to females, increasing their reproductory chances and thus adding to the general fitness.[119] Darwin tentatively noted that in humans "high cost, apparent uselessness, and manifest beauty usually indicated that a behaviour had a hidden courtship function"[120] and proposed that music developed as a means of "charming the opposite sex."[121]

The most prominent contemporary proponent of the theory of art as sexually selected is Geoffrey Miller who argues that among humans, much like among other species, "[s]ome males have higher fitness than other males, and they advertise their fitness using fitness indicators such as vigorous dancing, intelligent conversing, or realistic cave-painting."[122] Miller overlooks the fact, that should art serve merely a sexual selection function it would have been an exclusively male phenomenon, practised by males since puberty into early maturity, up to the point of successful

[119] Charles Darwin, *The Descent of Man, And Selection in Relation to Sex* (Princeton: Princeton University Press, 1981 [1871]), p. 262

[120] Geoffrey Miller, "Arts of Seduction," in: *Evolution, Literature and Film. A Reader*, eds. B. Boyd, J. Carroll, J. Gottschall, (New York: Columbia University Press, 2010), p. 158.

[121] Darwin, *Descent of Man*, p. 333-337.

[122] Geoffrey Miller, *Mating Mind* (New York: Doubleday, 2000), p. 196 .

mate selection. Afterwards it would be unnecessary for males to display their fitness.[123]

If Miller's theory is dismissive of the social dimension of both selection and art, focusing solely on mating interactions, Ellen Dissanayake's views of art stress the importance of its role in promoting social cohesion. In her first two books, *What Is Art For?* (1988)[124] and *Homo Aestheticus* (1992)[125], Dissanayake makes a number of interesting claims. She recognizes art as being a time and energy consuming activity which induces strong emotions (including pleasure) universally across all human societies. She also points out that contemporary Western art is not the most convenient place to start thinking of art in biological terms. Dissanayake argues that because of its tradition of art-for-art's sake, existent since the eighteenth century, Western art is heavily non-functional which makes it detached from the original conditions in which art emerged. Most importantly, however, Dissanayake puts forward a theory that art consists of "making special" those objects and activities that are of greatest importance for humans (such as birth, courting, tools etc.). Making these pleasurable or otherwise appealing guarantees that they receive the necessary attention, which is obviously beneficial. An objection to this proposition stems from the fact that many objects of great importance, such as ploughs for instance, are almost never artified while others, such as hand-axes, are of such critical importance that their artification does not matter as they continue to be used regardless of whether they are adorned in some way or not.[126]

Dissanayake's third book, *Art and Intimacy: How the Arts Began* (2000) presents a reformulated theory. In it, Dissanayake focuses on the communal aspect of

[123] Brian Boyd, "Evolutionary Theories of Art," in: *The Literary Animal,* p. 158.
[124] See: Ellen Dissanayake, *What Is Art For?* (Seattle: University of Washington Press,1988).
[125] See: Ellen Dissanayake, *Homo Aestheticus: Where Art Comes from and Why* (New York: Free Press, 1992).
[126] Boyd, "Evolutionary Theories of Art" p. 160-163.

"making special." She argues that common participation in apparently useless activities ensures the commitment of the group members to the group and serves to cement group cohesion. Religious rituals and other group ceremonies are costly because they require significant amounts of time and energy to prepare and perform, yet seemingly offer little in terms of immediate payoff. On the other hand, high-cost signals of that type are difficult to falsify. Through participating in them, an individual proves their loyalty and, as research shows, groups which engage in improving their cohesion by costly rituals have an advantage over groups which do not.[127]

Dissanayake is certainly correct in identifying the profound role art, especially in its religious and ritualistic incarnations, plays in increasing social cohesion. However, the social effects of art are insufficient to explain art's origin. Ceremonies and rituals are already dependent on a variety of more basic artistic endeavours not directly involved in enforcing social cohesion. What is more, art also exists in forms which are related more closely to play than to ritual. [128] Of course these objections do not entirely invalidate Dissanayake's claims. The improvement of social cohesion through shared artistic traditions, developed through common attention, might be, much like sexual selection stressed by Miller, one of the elements sustaining art's existence and one of the forces driving art's development.

The Evolutionary Importance of Fiction

In his 1984 paper titled "Evolutionary Epistemology" Karl Popper argued that the human capacity to know and learn is the result of natural selection and that the

[127] See: Ellen Dissanayake, *Art and Intimacy: How the Arts Began* (Seattle: University of Washington Press, 2000).
[128] Boyd, "Evolutionary Theories of Art" p. 166-167.

process of acquiring knowledge is in itself selective.[129] From this perspective two conclusions follow. Firstly, that the purpose of learning is to prepare an individual to cope with the central problem of uncertainty brought about by the endless changes in and of the world. Conrad Waddington formulated the problem in terms of "unknown future":

> the systematic exploration of the evolutionary strategies in facing an unknown, but usually not wholly unforecastable, future would take us into a realm of thought which is the most challenging and very characteristic of the basic problems of biology. The main issue in evolution is how populations deal with unknown futures.[130]

The solution to that problem is of course learning, the acquisition of information and knowledge necessary to survive. In 1965 Lorenz noted that "[t]he amazing and never-to-be-forgotten fact is that learning does, in the majority of cases, increase the survival value of the behaviour mechanisms which it modifies."[131] Secondly, in order to be successful, knowledge must be gained relatively quickly and efficiently, certainly within an individual's lifespan. This premise brings with itself another problem outlined by Henry Plotkin thus:

> if any and every form of learning, of knowledge gain, has evolved as an adaptive solution to Waddington's unknown futures problem, then it is a requirement that the process operate on a time scale much reduced from that of the main evolutionary programme which has given rise to it. Learning must be fast and frugal, to use the biologist Gerd Gigerenzer's phrase. But how can learning be fast and frugal if the number of potential forms of knowledge is "enormous if not infinite"? […] If learning occurred by way of the chance sampling and matching of all possible combinations of sensory input, then it would be, on average, a very slow, fumbling and inefficient process. It would not achieve the teleological results that were the reason for its original evolution.[132]

---

[129] Karl Popper, "Evolutionary Epistemology," in: *Evolutionary Theory: Paths into the Future*, ed. J.W. Pollard (Chichester: Wiley), pp. 239-255.

[130] C. H. Waddington, "Paradigm for an Evolutionary Process," in: *Sketching Theoretical Biology: Toward a Theoretical Biology Vol.2,* ed. C.H. Waddington (New Brunswick: Transaction Publishers, 2010), p. 122.

[131] Konrad Lorenz, *Evolution and Modification of Behaviour* (London: Methuen,19650. p. 12.

[132] Plotkin, *Evolutionary Worlds Without End,* p. 79.

Lorenz locates the answer to this problem in individuals having innate, instinctual knowledge of what they need to learn, a form of Kantian *a priori*. Furthermore, here in a split with Kant, Lorenz argues that the acquisition of proper knowledge through the senses is certainly possible. He asks: ”is it at all probable that the laws of our cognitive apparatus should be disconnected with those of the real world?”[133] and answers “no.” Human cognitive apparatus *must be* supplying humans with accurate and reliable information because not doing so would be counter-adaptive and would have caused our extinction a long time ago. If the shape of the human eye, or the shape of the human brain have been selected for, they must be working adequately well.

The second point raised by Popper concerns the selective nature of knowledge and science. According to Popper “the growth of our knowledge is the result of a process closely resembling what Darwin called 'natural selection'; that is *the natural selection of hypotheses*: our knowledge consists, at every moment, of those hypotheses which have shown their (comparative) fitness by surviving so far in their struggle for existence; a competitive struggle which eliminates those hypotheses which are unfit.”[134] Thus, according to evolutionary epistemology, learning is possible, necessary, governed by the principle of natural selection and to be most effective it should happen quickly. However, biological evolution alone would not be able to keep pace with human cultural evolution and would not be able to provide the *homo sapiens* with currently relevant innate knowledge of what is to be learned about the world in which profound changes can occur much faster than it is necessary for

[133] Konrad Lorenz, “Kant’s Doctrine of the A Priori in the Light of Contemporary Biology,” in: *Learning, Development and Culture: Essays in Evolutionary Epistemology*, ed. Henry Plotkin (Chichester: Wiley, 1982), p. 122.

[134] Karl Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford: Oxford University Press, 1979), p. 261.

biological evolution to occur. Nor would the process of trial and error learning be effective in the highly complex human social environments, because of the terminal dangers involved in making wrong judgements.

It is at this juncture that art, and particularly fiction, reappears in the discussion. In "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and Arts" (2001) John Tooby and Leda Cosmides present a number of arguments which support their main claim of art, and especially fiction, being an adaptation the main function of which is mental organization. As humans are endowed with great mental capacity for both storing information and for computing it, they have to posses the ability to deal with information that might be true, used to be true, may be true in the future, is true only in certain situations, someone believes to be true etc. Tooby's and Cosmides' claim is that fiction is the means through which the mind develops its capacity to perform this type of counter-factual reasoning.[135]

Tooby and Cosmides recognise that art is a "species-typical phenomenon"[136] and that for humans it is "an intrinsically rewarding activity, without apparent utilitarian profit."[137] They also argue that humans exhibit evidence of evolved cognitive design for engaging in and coping with fiction in their ability to efficiently and effortlessly decouple fictional information from factual information so that the fictional does not corrupt or interfere with our knowledge stores, the fictional input retained separately for possible future use. The existence of the specialized

[135] John Tooby, Leda Cosmides, "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and the Arts,"*SubStance*94/95, Vol. 30, No. 1&2 (2001), p. . 20.
[136] Tooby, Cosmides, "Does Beauty Build Adapted Minds?" p. 7.
[137] Tooby, Cosmides, "Does Beauty Build Adapted Minds?" p. 8.

decoupling mechanisms testifies to the fact that engaging in fiction is advantageous and thus adaptive.[138]

Moreover, the fact that humans should display a preference for engaging in fictitious activities, where it would seemingly be more beneficial to seek out accurate information and *reject* the fictional, is evidence of functional design. Tooby and Cosmides note with some amusement that the "appetite for the true" model fails when applied to humans, who consistently remain "intensely interested in communications explicitly marked as false."[139] In the case of imaginative fiction such as fantasy or science fiction the falseness itself might be the principal attractor. The "appetite for the true" or accurate information remains in force, however, when dealing with information intended as truthful. The conclusion is that "the switching off of an aversion to falsehood under predictable circumstances is an element that has seemingly been added to the human cognitive architecture."[140]

Approaching the issue from a non-adaptive perspective, Stephen Pinker, somewhat trivially perhaps, relies on the metaphor of "cheesecake for the mind" when discussing art's function. He recognizes that within the human brain there are evolved motivational mechanisms which give the sensation of pleasure, usually correlated with attaining a fitness increment (safety, sex, esteem etc.) and goal-achieving mechanisms which compel the mind to seek out ways of delivering enjoyment to the pleasure circuits of the brain.[141] Thus art becomes a means of providing the mind with pleasurable stimuli without the trouble of actually obtaining the fitness increments; it becomes a form of pleasure technology, or "cheesecake," which allows the mind to "enjoy [...] hallucinations like exploring interesting

[138] Tooby, Cosmides, "Does Beauty Build Adapted Minds?" pp. 9-10.
[139] Tooby, Cosmides, "Does Beauty Build Adapted Minds?" p. 12.
[140] Tooby, Cosmides, "Does Beauty Build Adapted Minds?" p. 12.
[141] Steven Pinker, *How the Mind Works* (London: Penguin Books, 1998), p. 524.

territories, conquering enemies [...] and winning attractive mates."[142] The conclusion is that human cognitive preferences did not evolve for art but are appealed to in it leads Pinker to surmise that art is not adaptive.

In his treatment of art as a by-product and a pleasure technology, Pinker makes a notable exception for fiction and the narrative to which he ascribes an adaptive role. He argues that intelligent systems, such as the human brain, benefit from reasoning through experiment. As generic strategies for success are fairly useless when applied to complex real-life problems, the most useful and instructive information is stored in highly detailed concrete scenarios. The scenario, along with its outcome is stored in memory and when the reasoner is faced with a problem, they search the memory for the scenario most reminiscent of the one encountered (case-based reasoning). Thus fiction, according to Pinker:

> would be a kind of thought experiment, in which agents are allowed to play out plausible interactions in a more-or-less lawful virtual world, and an audience can take mental notes of the results. Human social life would be a ripe domain for this experiment-driven learning because the combinatorial possibilities in which their goals may coincide and conflict […] are so staggeringly vast as to preclude strategies for success in life being either built-in innately or learnable from one's own limited personal experience.[143]

As fictitious plots are both cheap and abundant, they can provide valuable and numerous insights into a variety of possible human interactions. Fiction, as per Pinker, providing the grounds for testing and playing out possible scenarios, would increase the human capacity to learn about the world, supplementing the once-dominant capacity to learn through personal experience.

The thought experiment aspect of fiction was scrutinized by Peter Swirski in *Of Literature and Knowledge* where the author discusses the potential of fictional

---

[142] Steven Pinker, "Toward a Consilient Study of Literature," *Philosophy and Literature*, Vol. 31, No.1 (April 2007), p. 171, *Project MUSE*. Web. (10 Dec, 2011).

[143] Pinker, "Toward a Consilient Study of Literature," p. 172.

stories to generate nonfictional knowledge thanks to "their capacity for doing what philosophy and science do – generating thought experiments."[144] Swirski draws attention away from the aesthetic qualities of literature and toward studying it as an instrument of inquiry and argues persuasively in favour of treating it similarly to the way thought experiments are treated in philosophy and the sciences, that is as a valuable learning tool. Swirski elaborates on Roy Sorensen's concept of "gradualistic metaphilosophy," a contention that thought experiments in philosophy are continuous with thought experiments in science and that there is, therefore, a continuity between the two disciplines. Moreover Sorensen concludes that "thought experiments are stories"[145] to which Swirski adds that the point extends to literature and that thought experiments in literature lie on the same continuum with the obvious reservation that not all stories are thought experiments. Similar views were voiced by Alexander Argyros in "Narrative and Chaos" where he claims that a work of fiction may be considered "a hypothesis about the nature of the existing slice of reality or about the potential consequences of certain variations on a model of the world"[146] and can even be used to perform experiments on the reality which it models.

For E.O. Wilson art is exactly the means by which humans can cope with the vastness of possibilities brought about by their evolved intelligence.[147] Carroll agrees with this functional approach, adding that in creating models or images of people acting in the world, and imbuing them with emotion and moral value, literature creates general psychological maps used by readers to assess their behaviour and its alternatives.[148] This point translates directly into the relationship between

---

[144] Peter Swirski, *Of Literature and Knowledge: Explorations in Thought Experiments, Evolution and Game Theory* (New York: Routledge, 2007), p. 4 .

[145] Roy A. Sorensen, *Thought Experiments* (New York: Oxford University Press, 1992), p. 3 .

[146] Alexander Argyros, "Narrative and Chaos" in: *New Literary History*, 23, 1992, p. 667 .

[147] Wilson, *Consilience*, p. 225.

[148] See: Carroll, *Literary Darwinism*, chapters 6 and 7.

epistemology and fiction which is cheap, abundant, easily accessed, quickly assimilated and infinitely flexible, which in turn enables it to respond to the numerous possible situational combinations that can be encountered in the world much more easily and at a lower cost than other forms of learning.

In this sense, literature functions as a cultural repository of what Friedrich Hayek called "dispersed knowledge," a notion derived from his analysis of the free market system in which each of the participants possesses only a fraction of the knowledge of the total system, and yet is able to act rationally and effectively. This is made possible by the analysis of price variation, which supplies the market participant with enough information to decide a rational course of action.[149] Outside of the market system, in social and cultural spheres, the indicative function of the price mechanism, reflecting the dispersed, economic insights of large numbers of individuals, is performed by traditional conventions and norms of behaviour against which courses of action are decided and evaluated.[150] The injunctions of tradition need not be followed. Their existence in the dispersed form is sufficient for a tacit framework of cultural, social and moral reference to exist and aid in planning actions. Fictional plots can greatly increase this reference pool, particularly because they open access to a range of speculation much broader than the limits of any given individual's personal experience.

Science Fiction

The focus on "unknown future" as the object of inquiry and scenario testing as the means of it, leaves little doubt that science fiction is a privileged type of writing in

[149] Friedrich A. Hayek, "Economics and Knowledge," in: *Individualism and Economic Order* (Chicago: Chicago University Press, 1958).
[150] See: Friedrich A. Hayek, *Law, Legislation and Liberty* (London: Routledge, 1998).

this paradigm. While other types of fiction can fall anywhere on the spectrum of their epistemological usefulness, varying from genre to genre and even from one reader to another, possibly serving no function other than being pleasurable, science fiction makes its role clear. The assertion follows naturally from the definitions of the genre. For Darko Suvin, science fiction is a mode "whose necessary and sufficient conditions are the presence and interaction of estrangement and cognition, and whose main formal device is an imaginative framework alternative to the author's empirical environment.[151] Suvin points out that the "alternative framework" must remain possible, constrained by logical principles, which even if imaginary and ruled out by science as we know it, must adhere to a certain causal rationality. Suvin proposes that the term "novum" be used to refer to the element of estrangement introduced in science fiction and thus the mode of writing becomes one in which the novum is foregrounded as a particular epistemological problem, the subject of speculation and the object of the cognitive experiment and by necessity it is "postulated on and validated by the post-Cartesian and post-Baconian scientific *method.*"[152]

Gwyneth Jones' description of science fiction and its *modus operandi* is very similar to Pinker's general description of fiction's function. Jones writes:

> whatever phenomenon or speculation is treated in [science] fiction, there is a claim that it is going to be studied to some extent scientifically – that is objectively, rigorously; in a controlled environment. The business of the writer is to set up the equipment in a laboratory of the mind such that the "what if" in question is at once isolated and provided with the exact nutrients it needs.[153]

---

[151] Darko Suvin, *Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre* (New Haven: Yale University Press, 1979),pp. 8-9.

[152] Suvin, *Metamorphoses of Science Fiction,* p. 65.

[153] Gwyneth Jones, *Deconstructing the Starships: Science, Fiction and Reality* (Liverpool: Liverpool University Press, 1999), p. 4.

The stressing of the rigorousness of the "cognitive logic"[154] with which the novum is to be approached is a further testimony to the epistemological role of science fiction, directly derivative from Pinker's definition and his insistence that fiction plays out its possible scenarios in a "more-or-less lawful virtual world." To retain its value, a fictitious plot must take place within the limits of a non-arbitrary virtual reality, in the case of science fiction delineated either by a speculated science of pseudo-science which, regardless of the level of its "pseudosness," must obey the rules of its own game, that is, the rules of the scientific method or otherwise lose its relevance.

It is so, because while cultural activity is enabled by biological dispositions, it, in turn, can affect these dispositions through what John Odling-Smee, Kevin Laland and Marcus Feldman call "self-induced selection pressures."[155] These arise when organisms actively engage with their surroundings in the process of niche construction and "choose their own habitats, mates, and resources and construct important components of their local environments such as nests, holes, burrows, paths, webs, dams, and chemical environments."[156] Or skyscrapers and cars – the mechanism is readily apparent in humans and applicable to cultural artefacts, although on a scale and at a velocity much greater than in the case of earthworms or moles. Indeed, what the human race is witnessing is the explosive creation of cultural niches and the proliferation of self-induced pressures. From Post-It notes, through the Tzar Bomb to the World Wide Web, the twentieth century alone brought with itself so much advancement and so many threats, actual, possible and imagined, opened so many doors leading to unknown places, sometimes very literally, as evidenced by the exploration of the oceanic abyss or the void of space, that the emergence of a

---

[154] Suvin, *Metamorphoses of Science Fiction*, p. 63.

[155] F. John Odling-Smee, Kevin Laland and Marcus Feldman, "Niche Construction," *The American Naturalist*, Vol 147, No.4 (April 1996), p. 641.

[156] Odling-Smee, Laland and Feldman, "Niche Construction," p. 641.

phenomenon which would allow to probe into the unknown futures, openly and explicitly, can be considered an evolutionary necessity, given that, as Jerome Bruner put it, "we organize our experience […] mainly in the form of narrative."[157] Science fiction is thus a necessary response to the proliferation of cognitive problems brought about by technological and social change.

To that effect, the science fiction nova, the elements of otherness constituting the central formal devices of science fiction texts, usually come from a fairly limited set of categories, derived from and relevant to either the present, the projected or the speculated technological achievements of humanity such as interstellar travel and alien species of the "Golden Age of Science Fiction" for the Space Age, interacting with robots or other forms of advanced technology, computers and virtual reality of cyberpunk for the Information Age, or genetically modified and transformed humans for the present age, expressed in a cyberpunk derivative referred to as "biopunk." Once the speculated element of novelty appears in the real world, it will have been already narrated, already explored and already mentally experimented on and thus, in the words of John Huntington, science fiction "manages to domesticate the future, to render it habitable and, in spite of a somewhat strange surface, basically familiar."[158] Patrick Parrinder, similarly argues that "[a] fiction that is estranged in Suvin's terms may, however, make us feel at home in a particular future provided that it offers a new angle of perception and so familiarizes us with a different view of the present. […] Estranged fiction needs to change our view of our condition."[159]

When "the future happens" it is already known. As Adam Robert argues:

---

[157] Jerome Bruner, *Acts of Meaning* (Cambridge: Harvard University Press, 1990), p. 43 .

[158] John Huntington „Science Fiction and the future," in: *Science Fiction: A Collection of Critical Essays*, eds. Mark Rose (Englewood Cliffs, NJ: Prentice-Hall, 1976), p. 166.

[159] Patrick Parrinder, "Re-VisitngSuvin's Poetics of Science Fiction," in: *Learning from Other Worlds: Estrangement, Cognition and the Politics of Science Fiction and Utopia*, ed. P. Parrinder (Liverpool: Liverpool University Press, 2000), p. 40.

> The symbolic purchase of SF on contemporary living is so powerful, and speaks so directly to the realities of our accelerated culture, that it provides many of the conceptual templates of the modern Western world. The complex debates surrounding the genetic engineering of foodstuffs, for instance, enter popular consciousness in SF terms as 'Frankenstein foods'. The dangers of asteroid impact on our world find expression in such SF texts as the films *Deep Impact* (1997) and *Armageddon* (1998). Our feelings about computers have been rehearsed by every SF text that includes Artificial Intelligence; actual exploration of our solar system seems tame to us because our expectations have been raised by the thrills of the SF imagery; many people regard the trope of UFO abductions to be fact rather than science fiction, partly because of the expertness of SF texts such as *The X-Files*. As Istvan Csicsery-Ronay Jr puts it, 'SF has ceased to be a genre *per se*, becoming instead a mode of awareness about the world' (Csicsery-Ronay1991:308). SF does not project us into the future; it relates to us stories about our present, and more importantly about the past that has led to the present.[160]

In short, science fiction is, at least to an extent, certainly a mode of writing in which a subject is repeatedly and perpetually (and purposefully) made to try and make sense of the world, try and find itself in it and – most importantly – try and survive in it. Thus science fiction is charged with an epistemological function and it is not entirely correct to focus solely on the ontological character of science fiction, a practice apparently favoured by post-structuralist critics.

In *Constructing Postmodernism* (1992) Brian McHale develops an interesting history of science fiction in which he recognizes that each of the genre's consecutive oscillations, from the Golden Age, through New Wave to cyberpunk is marked by an "ever closer aesthetic contemporaneity"[161] to mainstream postmodern fiction. McHale speaks of a "peculiar relationship of nonsychronization between SF and advanced mainstream fiction […] with each reflecting an outdated phase of the other,"[162] that is the 1950s authors imitating the best-seller techniques, the New

---

[160] Adam Roberts, *Science Fiction* (London: Routledge, 2000), pp. 35-36.

[161] Istvan Csicsery-Ronay „An Elaborate Suggestion„" *Science Fiction Studies*, Vol.20, No.3 (1993), p. 458.

[162] Brian McHale, *Constructing Postmodernism* (London: Routledge, 1992), p. 228.

Wave writers turning to literary modernism and postmodern writers such as Pynchon and Burroughs borrowing from pulp science fiction. For McHale the two unsynchronised modes ultimately "meshed to create a science-fictionized mainstream and postmodernized SF distilled in cyberpunk."[163]The discussion leads McHale to conclude that

> my conviction has grown that SF, far from being marginal to contemporary "advanced" or "state-of-the-art" writing, may actually be paradigmatic of it. This is so in at least two respects. First, SF is openly and avowedly ontological in its orientation, i.e., like "mainstream" postmodernist writing it is self-consciously world-building fiction, laying bare the process of world-making itself. Secondly, SF constitutes a particularly clear and demonstrable example of an intertextual field, one in which models, materials, images, "ideas," etc. circulate openly from text to text, and are conspicuously cited, analyzed, combined, revised, and reconfigured. In this it differs from "mainstream"postmodernism only in the openness and visibility of the process. It is precisely this visibility of intertextual circulation in SF that makes it so valuable as a heuristic model of literature in general, and postmodernist literature in particular.[164]

He contrasts modernist fiction and its focus on the relatively centred subject trying to wind its way through reality in search of truth (the *epitome* of which is detective fiction) with the postmodern "ontological dominant" of the fragmented subject exposed to the multiverse of experience as a defining feature of science fiction:

> While epistemologically-oriented fiction (modernism, detective fiction) is preoccupied with questions such as: what is there to know about the world? and who knows it, and how reliably? How is knowledge transmitted, to whom, and how reliably?, etc., ontologically-oriented fiction (postmodernism, SF) is preoccupied with questions such as: what is a world? How is a world constituted? Are there alternative worlds, and if so, how are they constituted? How do different worlds, and different kinds of world, differ, and what happens when one passes from one world to another, etc.?[165]

---

[163] Csicsery-Ronay "An Elaborate Suggestion,"p. 459.

[164] McHale, *Constructing Postmodernism*, p. 13.

[165] McHale, *Constructing Postmodernism*, p. 247.

However, as Istvan Csicsery-Ronay correctly notes, McHale makes a serious omission in equating cyberpunk science fiction with the ontological chaos of postmodernity:

> Behind and within all the worlds-within-and-alongside-worlds, experiences, identities, and conditions of existence that are neither life nor death, there is a continuum which determines the relative importance of the thematic elements: namely, the history of technology. Technology's almost autonomous force, distributed through machines, drugs, bionics, cyborgs etc., saturates cyberpunk and indeed most SF – to a degree that it demands to be viewed as a driving principle overriding all other lesser powers. If there is a thematic dominant in cyberpunk (and perhaps SF in general) it is technology, for it is the concrete, unguided and global transformative power of technology that inspires the widespread concern with worlds in contemporary culture which McHale calls ontological. Technology, however unlike ontology, has a material social history that both determines and is determined by other cultural practices it can be socially and politically unconscious, even in art. It can be suffered, comprehended, contested, joined, and even avoided [...]. It is a ground for fiction. [166]

Thus, considering science fiction in terms of pure aesthetics or poetics proves insufficient and inadequate and leads McHale astray. While Csicsery-Ronay's argument is certainly correct, there seems to be another crucial point which McHale's discussion of science fiction is unable not only to address but to recognise, namely the question of science fiction's purpose. The remarks about the nonsynchronised aesthetics of science fiction (which are correct) overshadow an important fact that *thematically* the dominant currents of science fiction are *synchronised* with their cultural and technological context, which is not surprising as their function is to address challenges as they appear. Hence, to speak of science fiction solely in terms of ontology is a mistake, an incomplete account which can be readily supplemented by the epistemological considerations derived from evolutionary theory. If the tactics

[166] Csicsery-Ronay, "An Elaborate Suggestion", pp. 461-462.

of science fiction are ontological, the underlying general strategy definitely has an epistemological dimension.

It has to be noted, that the epistemological value of science fiction is retained even in those cases when the mechanism of scenario testing is quite inaccurate. Even though very few of science fiction's predictions have actually come true in the form they were first postulated, the accuracy of the actualisation is not important. It is the process itself that matters and its value is independent of any stipulated correctness of a science fiction proposition. The explanation for this is linked to John Dewey's idea of collateral learning. In *Experience and Ecudation* Dewey writes:

> Collateral learning in the way of formation of enduring attitudes, of likes and dislikes, may be and often is much more important than the spelling lesson or lesson in geography or history that is learned. For these attitudes are fundamentally what count in the future. The most important attitude that can be formed is that of desire to go on learning.[167]

For science fiction the attitudinal enhancement will affect not only learning, but the very idea of coming into contact with difference, strangeness and otherness implicit in the notion of an unknown future. The mechanism which enables such attitude enhancement is the "mere exposure effect."

In a 1968 paper "Attitudinal Effects of Mere Exposure," Robert B. Zajonc observed that

> [t]he first encounter with the novel stimulus produces fear reaction. If no negative consequences are associated with this first encounter, the avoidance reaction upon the second encounter will naturally be weaker. If such encounters continue, and if no other events – negative in their consequences for the organism – accompany these encounters, then the organism's attitude toward the stimulus must improve. The exposure of a stimulus coupled with reward will strengthen the animal's approach behaviour; and the exposure of stimulus coupled with a noxious event will strengthen his avoidance reactions. But in the absence of reward or punishment,

[167] John Dewey, *Experience and Education* (New York: Touchstone, 1997 [1938]), p. 48.

> mere exposure will result in the enhancement of the organism's attitude toward the given stimulus object.[168]

The preference for the familiar arises because, as Eddie Harmon-Jones and John B. Allen argue, "new objects could present a potential threat [and] organisms that had a fear of the strange and unfamiliar were more likely to survive, reproduce, and pass on genetic material and inherited traits to subsequent generations than organisms that lacked the fear of novelty."[169]Thus, it is "adaptive […] to prefer the familiar over the novel."[170] In the paradoxical case of science fiction, it is exactly the novel which becomes familiarised through exposure to itself.

Subsequent research into the phenomenon not only confirmed its occurrence in humans,[171] but also drew attention to a number of factors which influence its intensity. Among these are, for instance, exposure duration, the ability to recognise the stimulus, and quite crucially boredom. According to Robert Bornstein, Amy Kale and Karen Cornell, "complex stimuli have been found to receive more positive ratings than simple stimuli, [since they] become boring more quickly."[172] One possible evolutionary explanation of this is that "it is adaptive to grow bored with stimuli that, after many repeated exposures, have never been associated with any type of positive reinforcement. As a stimulus proves itself to be neither dangerous nor reinforcing, one simply loses interest in it and turns one's attention to other familiar stimuli that have proved rewarding."[173]

---

[168] Robert B. Zajonc, "Attitudinal Effects of Mere Exposure," *Journal of Personality and Social Psychology Monograph Supplement* Vol.9, No.2, Part 2 (June 1968), p. 20.

[169] Eddie Harmon-Jones and John J.B. Allen, "The Role of Affect in the Mere Exposure Effect: Evidence from Psychophysiological and Individual Differences Approaches," *Personality and Social Psychology Bulletin,* Vol. 27, No.7 (July 2001), p. 890.

[170] Robert F. Bornstein, "Exposure and Affect: Overview and Meta-Analysis of Research 1968-1987," *Psychological Bulletin,* Vol. 106, No.2 (1989), p. 282.

[171] For an overview see: Bornstein, "Exposure and Affect," p. 265-289.

[172] Robert F. Bornstein, Amy R. Kale, Karen R. Cornell, "Boredom as a Limiting Condition on the Mere Exposure Effect," *Journal of Personality and Social Psychology,* Vol. 58, No.5 (1990), p. 791.

[173] Bornstein, "Exposure and Affect," p. 282.

What this observation implies about science fiction is that, because it is focused on a fairly narrow set of themes and problems, the genre is at risk of becoming uninteresting and unrewarding, which would prevent it from performing its functions. In order not to become boring, science fiction relies on a number of narrative strategies specifically aimed at drawing attention to itself and making itself interesting. These strategies are discussed in the following two chapters.

Conclusion

There is little direct evidence to testify to science fiction's adaptive usefulness. Indeed, the effect of a literary phenomenon on a species' fitness is, quite literally, immeasurable. However, recent observations on popular culture seem to provide indirect evidence for the correctness of the above claims.

In *Everything Bad is Good for You* Steven Johnson presents a set of striking claims which certainly go against the grain of public discourse on popular culture. Johnson observes, using the plot structures of police procedural series and soap operas as examples, that mass culture is becoming progressively more complex. Where an episode of *Dragnet* or *Starsky and Hutch* might have a single plot line, an episode of *The Sopranos* would have as many as nine, interacting and influencing one another. Rather than stupefying the viewers, the shows in question become more and more engaging and require more and more attention to follow the multiple plot strands. Similarly, some computer games (role-playing games, grand strategy games and adventure games in particular) reach levels of complexity previously unimaginable and engaging the players in cycles of "probing, hypothesising, reprobing and rethinking" thus compelling them to operate and interact with the

games' environments according to the fundamentals of the scientific method. The viewers and gamers react to these complex structures enthusiastically. Rather than shy away from the challenge that these cultural artefacts are, the audiences devote their attention, time and creativity to solving puzzles, predicting possible story outcomes and discussing their particular intricacies on numerous websites and message boards.

Johnson tentatively links the phenomenon of increasing complexity with the Flynn Effect, an observable increase in the average IQ level and goes farther to say:

> When cinema first became a mainstream diversion in the early 1900s, the minds of that era were not primed to master ten new technologies and dozens of new genres in the next decade; they had to adapt to the new conventions of movie going, learning a new visual language, and a new kind of narrative engine. But as the new technologies started to roll out in shorter and shorter cycles, we grew more comfortable with the process of probing a new form of media, learning its idiosyncrasies and its distortions, its symbolic architecture and its rules of engagement.
>
> The mind adapts to adaptation. Eventually you get a generation that welcomes the challenge of new technologies, that embraces new genres with a flexibility that would have astonished the semi-panicked audiences that trembled through the first black-and-white films.[174]

If Johnson's point is correct, then science fiction, conceived of in the most general terms, can be understood to perform adaptively by lowering the future shock, by negotiating new technologies and their impact and by facilitating the development of cognitive skills necessary to cope with unknown (but increasingly more technological) futures.

[174] Steven Johnson, *Everything Bad is Good for You* (New York: Riverhead Books, 2005), p. 178.

CHAPTER 3: TO BOLDLY GO… : SCIENCE FICTION AND SPACIAL EXPLORATION

> So here we were, fifty men and fifty women, with IQs over 150 and bodies of unusual health and strength, slogging cutely through the mud and slush of central Missouri, reflecting on the usefulness of our skill in building bridges on worlds where the only fluid is an occasional standing pool of liquid helium.
>
> Joe Haldeman, *The Forever War*

"The two things for which science fiction is best known are these: the creation of new environments and the evocation of the sense of wonder"[175] writes Michael Marshall Smith in the foreword of *Lost in Space. Geographies of Science Fiction Continuum*. There is little doubt that science fiction is preoccupied with concepts and representations of space. This preoccupation is equally visible in the actual literary works and in the criticism which accompanies them. It is so because science fiction is capable of creating and envisaging new spaces and humans, the audience, the readers and the critics alike, cannot resist the urge to explore them. In this chapter I will argue that the generation of these new spaces as well as their shape, functions and perceptions are non-random, motivated and structured, partly, by the evolutionary framework of the human mind. This generation serves a double purpose: firstly and most basically, science fictional spaces serve as settings for, and objects of, experimentation, providing a necessarily removed background for the alternative paradigm to exist in. The temporal, spatial or conceptual displacement enables the realisation of cognitive estrangement. Secondly, these spaces can serve more actively as means of mapping the particular problems taken up by respective texts onto them, in order to facilitate comprehension and cognition.

---

[175] Michael Marshall Smith, "Foreword," in: *Lost in Space. Geographies of Science Fiction* (London and New York: Continuum, 2002), p. xi

.

These two purposes rely on the innate human interest in spaces and landscapes, derived from the adaptive pressures faced by early humans in the ancestral settings. This interest in turn, serves as a foundational element of science fiction poetics, an evolutionarily derived framework upon which the structures of meaning of science fiction ultimately rest.

Science Fiction and Heterotopia

Science fiction and its spaces exist in a close relationship to Michel Foucault's concept of heterotopia, an "other space." On the one hand, science fiction is firmly heterotopic, due to its reliance on estrangement, which leads to narrative creation of spaces which, following Foucault's definition of heterotopia, are spaces "that have the curious property of being in relation with all the other sites, but in such a way as to suspect, neutralize or invert the set of relations that they happen to designate, mirror or reflect"[176] and in which "all the other real sites that can be found within a culture, are simultaneously represented, contested and inverted."[177]

Foucault makes a distinction between crisis heterotopias, that is "privileged or sacred or forbidden places, reserved for individuals who are, in relation to society and to the human environment in which they live, in a state of crisis"[178] and heterotopias of deviation, that is "those in which individuals whose behaviour is deviant in relation to the required mean or norm are placed."[179] Fiction as estranged as science fiction, with its alternate cognitive framework as a central element, always presupposes a deviation from the norm, and the presence or appearance of radical

[176] Michel Foucault, "Of Other Spaces," Diacritics vol.16, No.1 (Spring, 1986), p. 24.
[177] Foucault, "Of Other Spaces," p. 24.
[178] Foucault, "Of Other Spaces," p. 24.
[179] Foucault, "Of Other Spaces," p. 25.

alterity always causes a state of crisis both on the level of diegesis and for the reader confronted with it.

Furthermore, Foucault observes that "a society, as its history unfolds, can make an existing heterotopia function in a very different fashion; for each heterotopia has a precise and determined function within a society and the same heterotopias can, according to the synchrony of the culture in which it occurs, have one function or another."[180] Even a cursory look at the history of science fiction will confirm that thematically it remains closely tied to the crises of its present. The correspondence is not one-to-one, but it is possible to discern thematic dominants: the fascination with space travel before the advent and in the early stages of the Space Age; the permeating apocalyptic themes of Cold War science fiction; the speculative shift towards innerspace of the human mind dominating New Wave science fiction; the fascination with computers and information technologies defining cyberpunk.

Yet further, heterotopias "are most often linked to slices in time – which is to say that they open onto what might be termed, for the sake of symmetry, heterochronies. The heterotopia begins to function at full capacity when men arrive at a sort of absolute break with their traditional time."[181] Examples provided by Foucault: cemeteries, museums, libraries or prisons, all offer such breaks with traditional time. Science fiction and its spaces are no different. In the most general sense, the possible futures of science fiction are perpetual: a story which is temporally located in the future will always take place in it, regardless of the actual, real-world date. An unspecified date of the diegesis (such as the "seven years from now" in Dick's *A Scanner Darkly*) ensures this perpetuity even stronger.

---

[180] Foucault, "Of Other Spaces," p. 25.
[181] Foucault, "Of Other Spaces," p. 26.

Despite the fact that heterotopias are radical reinventions of existing orders they are not unstructured. To the contrary, while the rules within a given heterotopia may differ significantly from those outside of it, heterotopic spaces are even more regulated than standard spaces. The exemplary spaces provided by Foucault are all rigidly ordered, strictly delineated and tightly constricted. Importantly, however, in case of fiction, the deviating rules, the subversions of order, are often only visible to the reader: on the level of science fiction diegesis the physics of a spaceship in zero gravity or a social organisation in which polygamy is the norm rather than an exception are understood as normative.

Therein lies the paradoxical relation: in order to ensure alterity, "the strange newness" and essential transgresiveness the subversive heterotopias of science fiction are often themselves subverted through "a notion of a science fictional space that exists parallel to the normal space of the diegesis – a rhetorically heightened 'other realm'."[182] To expand upon Benjamin Harshaw's proposition in textual ontology, according to which the real and fictional worlds establish their own, parallel fields of reference the exact relation between which are mediated for the reader by the text, thus forming a "double decker" structure, science fiction establishes another field of reference, a "triple decker."[183]

Bukatman goes as far as to call the presence of these paraspaces "endemic to the genre of science fiction."[184] These paraspaces serve as heterotopias of heterotopias, spaces in which the inverted rules invert upon themselves. Their presence contributes to the emergence of a pattern of world building and narrative structuring in which the primary heterotopic space is clearly delineated, constricted

---

[182] Scott Bukatman, *Terminal Identity. The Virtual Subject in Postmodern Science Fiction* (Durham and London: Duke University Press, 1993), p. 157.

[183] Benjamin Harshaw, "Fictionality and Fields of Reference: Remarks on a Theoretical Framework," *Poetics Today*, Vol.5, No.2 (1984), p. 227-251.

[184] Bukatman, *Terminal Identity*, p. 157.

or compartmentalised and needs to be breached, opened or ventured out of, into the secondary heterotopia of the paraspace.

The Narrative Pattern of Exploration

This narrative pattern is the foundation of the space-operatic and exploratory streaks of science fiction. Spaceships, other-world colonies and scientific outposts are the primary heteretopias of these sub-genres and their heterotopic character is clearly evident from Foucault's formulation, which argues, pointing out the imaginative aspect, that

> if we think, after all, that the boat is a floating piece of space, a place without a place, that exists by itself, that is closed in on itself and at the same time is given over to the infinity of the sea and that, from port to port, from tack to tack, from brothel to brothel, it goes as far as the colonies in search of the most precious treasures they conceal in their gardens, you will understand why the boat has not only been for our civilization, from the sixteenth century until the present, the great instrument of economic development (I have not been speaking of that today), but has been simultaneously the greatest reserve of the imagination. The ship is the heterotopia par excellence. In civilizations without boats, dreams dry up, espionage takes the place of adventure, and the police take the place of pirates.[185]

The alien landscapes of far-way planets and moons, all that lies outside, are the secondary, paraspatial heterotopic zones. It is there, on the outside of the alternate, but regulated spaces, where the contact with otherness occurs and where the adventure of exploration takes place. The act of crossing the border of the known becomes crucial in enabling it to happen, and it is this act which triggers any potential cognitive relevance of the contact.

Popular television shows, such as *Star Trek* or *Dr Who,* are organised around this pattern of exploration, with their iconic vessels, the *Enterpise* and the TARDIS,

[185] Foucault, "Of Other Spaces," p. 27.

and their „strange new worlds." Outside the doors of the TARDIS „we might see anything, we could find new worlds, terrifying monsters, impossible things"[186] the Doctor promises. Likewise, *Stargate SG-1*, *Stargate Atlantis* and *Stargate Universe* all use the premise of a primary heterotopic location (a secret military base, an abandoned city of ancient aliens, or a derelict alien spaceship, respectively) as a starting point for interplanetary excursions which enable the heroes to encounter numerous alien races and their civilisations. In *Battlestar Galactica*, the primary heterotopia is the titular warship, fighting its way through enemy-occupied space.

In military science fiction, such as Heinlein's *Starship Troopers*, Haldeman's *The Forever War*, or Card's *Ender's Game*, the heroes proceed through the primary heterotopias of boot camps or military academies in order to enter the secondary heterotopias of the battlefields. The attention moves away from exploration, but the fundamental pattern is retained, even accounting for the obvious differences between the respective novels. Where Haldeman realises the heterotopicity of his battlefields through the incorporation of progressively more evident time dilation effects, relying on mounting temporal displacement of his heroes, Card's battlefields present themselves to the hero as simulated exercises, with their initial parameters and arbitrary rules of engagement, not even recognised as actual battles until the final chapters of the novel.

The narrative template is also present in computer games. Each of the five major instalments of the post-apocalyptic role-playing *Fallout*[187] series (1997-2015) starts with the hero character forced to leave an underground nuclear shelter, and to venture into the post-nuclear Wastelands which they then explore in order to

[186] Season 2 Trailer, *Dr Who* (BBC One, 2005).

[187] Interplay Entertainment, *Fallout* (Interplay Entertainment, 1997); Black Isle Studios, *Fallout 2* (Interplay Entertainment, 1998); Bethesta Game Studios, *Fallout 3* (Bethesda Softworks, 2008); Obsidian Entertainment, *Fallout New Vegas* (Bethesda Softworks, 2010); Bethesda Game Studios, *Fallout 4* (Bethestda Softworks, 2015).

complete the games' quests. The shelters (Vaults) are decidedly heterotopic settings: closed-off, constricted spaces, suspended in time and, as each of the Vaults had been somehow tampered with by the government agency responsible for their construction (either through sabotage of vital machinery, or through pre-selecting their inhabitants in such ways as to create particularly stressful social conditions), offering an assortment of alternative models of social and technological organization. The outlying Wasteland, in contrast, is an absolute unknown: initially, both the player and their character know nothing of what can be encountered there: the mutated life forms and the recovering human civilization with its new models of societal and cultural organization has to be explored, comprehended and learned to navigate through in the course of the game. There exists a direct relation between exploration, character development and plot progression: as more of the unknown territory is explored, the player is given choice of how to shape their character in terms of physical and mental capabilities, which in turn allows them to further the game's narrative.

In *Assassin's Creed*,[188] a much more action-oriented game, the relation between subject constitution and exploration is even more literal. The object of the game is to regain the memories of a medieval assassin, Altair, stored in the DNA of his modern-day descendant Desmond. The contemporary part of the plot takes place in a secret, isolated research facility (a primary heterotopia) in which Desmond accesses and relives the memories of Altair in a virtual reality-like memory space (a paraspace). The exploration of this space, a recreation of Third Crusade Holy Land, consists of climbing and accessing vantage points (church towers or minarets) from which Altair learns the layout of a city he is in. Again, the more space is seen by him,

[188] Ubisoft Monrtreal, *Assassin's Creed* (Ubisoft, 2007).

the more is available to be entered and the more memories are regained. The relation between the reconstitution of Altair's identity and spatial exploration is direct and forms the crucial gameplay element for one of the most successful video game franchises in history.

What the video games examples highlight, other than the intense, multi-layered heterotopicity of science fictional spaces, is their transformative, constitutive or de-constitutive, capacity towards the human subject. Because they are outlying zones of paradigmatic subversion, the act of crossing into them becomes a liminal experience, and the journey through them becomes a localised and contextualised, rather than merely symbolic, rite of passage. In its basic form, as outlined by Victor Turner, the rite of passage consists of three stages: the stage of separation, in which the subject is removed from their fixed social or cultural point; the liminal stage, in which the subject passes through a zone of in-betweenness, ambiguity and indeterminacy, and which is effectively Foucault's "crisis heterotopia," and the reincorporation stage, in which the now-transformed subject is reincorporated into the cultural order.[189] This succession mirrors, and to an extent explains the narrative pattern outlined above: because science fiction is always alternative to existing conceptual orders, what constitutes its normative social and cultural context is already heterotopic. It is in relation to this heterotopicity that the crisis heterotopia of the liminal zone, a "cultural realm which has few or none of the attributes of the past […] state,"[190] is established.

---

[189] Victor Turner, *The Ritual Process. Structure and Anti-Structure* (Ithaca: Cornell University Press, 1991, 7th printing), p. 94.

[190] Turner, *The Ritual Process*, p. 94.

In the examples listed so far, the liminal paraspaces were places of becoming: the exploring subjects established themselves as subjects in relation to the territory explored.

J.G. Ballard's spaces become surrealistically conflated with the human mind. The conflation follows from Ballard's realization that "the biggest developments of the intermediate future will take place, not on the Moon or Mars, but on Earth, and it is inner space, not outer, that needs to be explored."[191] By looking at mental processes in terms of spatiality, by mapping the inner onto the outer Ballard employs buildings and structures to embody a number of psychological and emotional tensions, contradictions and other thought processes and metaphorically uses the external to represent a host of psychological and moral issues, all having to do with what Andrzej Gasiorek calls the "unprecedented scale of twentieth century social and technological change."[192]

The second novel of Ballard's Four Elements Quartet, the 1962 *The Drowned World*[193] is an example of how destructive spatial exploration can be. The apocalyptic forces in the novel are brought about by solar flares causing global warming, planet-wide floods and the proliferation of flora and fauna resemblant of the Triassic. In this hostile habitat the human race is reduced to a fraction of its original population, the survivors forced to live in the polar regions with scientific expeditions futilely trying to map the ever-changing landscape of jungles and lagoons. The protagonist, Dr Kerans, finds himself suffering from strange dreams of pulsating sun and bellowing reptiles and is shocked to find that other members of his scientific expedition (the detached camp being the primary heterotopic space)

[191] J.G. Ballard, *A User's Guide to the Millenium* (New York: Picador, 1996), p. 197.
[192] Andrzej Gasiorek, *J.G. Ballard* (Manchester: Manchester University Press, 2005), p. 9.
[193] J.G. Ballard, *The Drowned World* (New York: Harper Perennial, 2005 [1962]).

experience the same dream. A fellow scientist, Dr Bodkin offers an explanation: as the environmental conditions revert to their past form, so does the human psyche refocus and reshift to resemble that of the past. Growing progressively detached and disassociated from his duties, associates and obligations, Kerans ultimately gives in to a rapidly developed overwhelming yearning and undertakes a doomed journey south, towards the mounting heat and rampant jungles (into the unknown, paraspatial zone).

Kerans' behaviour is contrasted with that of the military escort provided for the expedition, under the command of Col. Riggs, and a band of scavengers and looters led by one Strangmann. While the soldiers cling to the old ways and traditions and remain faithful to their mission to the end, struggling to perform the tasks they were charged with, thus representing humanity's ongoing struggle with the suddenly hostile nature, Strangmann's band adapts to the new situation, commandeering a ship and living off of the remains of the civilisation. It would appear that Kerans would/should choose one these models of behaviour, yet as the novel's plot unravels so does his psychological structure. His higher social functions shut down which is evidenced by Kerans' detachment from both his academic duties (rendered pointless, as the environmental changes cannot be stopped and once Kerans and Bodkin come to understand what is happening to their psyches there is nothing else to be done) and his social obligations. The more fundamental reproduction drive is no longer active and Kerans' sexual detachment is possibly the most tell-tale phenomenon here: he withdraws from his partner and apathetically chooses not to engage in competing for her favours against Strangmann, thus ultimately turning away from the most basic of all drives, the drive to reproduce. And he does so not because he is incapable of successful competition, but simply

because there is not any point in it – earlier in the novel the reader learns that human fertility rates are dropping and the chance of successful reproduction is minute. Ultimately even the basic drive to survive and to struggle is made irrelevant by Kerans' suicidal trip south from which there is no hope of his returning. As the external landscape and environmental conditions change, Kerans' brain and mind are unable to make sense of the world – unsurprisingly, as they are not meant to function in this "Past Perfect" version of it in the first place.

The Evolutionary Necessity of Exploration

The ubiquity of the exploration pattern, while not absolute nor totalising, is too evident to be accidental. It is historically stable, is present in different media and its basic shape is impervious to contextual modification. It is also consistent with the evolutionary account of how humans interact with their environment.

As noted, human ancestral settings are grouped as the postulated Environment of Evolutionary Adaptedness, the EEA, or, as Robert Foley puts it "simply a code word for the accumulated effects of human evolutionary history."[194] Despite the elusiveness of the concrete features of the EEA, it is rather obvious that the ability to navigate through an environment, to locate places and landmarks, and to be able to learn about it and to use that knowledge later confers a significant adaptive advantage.

In order to secure the attainment of the knowledge of their surroundings, humans developed what Stephen Kaplan refers to as "concern for information," which

[194] Foley, "The adaptive legacy of human evolution," p. 194.

> is considered a basic part of the human makeup. "Concern" as it is used here is intended to cover a wide spectrum of human affective relationships. There is the motivation to seek information, to be "the first to know," and to discuss it with others. There is the distress that comes from struggling with information that is hard to understand, or inappropriate for the current situation, or not what one expected. There is the joy of recognizing and predicting despite uncertainty, or using information confidently and effectively.[195]

An implication of these observations is that since knowing is affective instead of being merely cognitive, not-knowing produces distress, and the distress, confusion and frustration caused by the state of not-knowing all have adaptive implications as they engage the motivational systems inducing the individual to learn. The attainment of knowledge is pleasurable and the sense, or want, of pleasure reinforces the motivation to explore. This closely follows the central assumptions of evolutionary epistemology discussed earlier: that learning is possible and necessary as it enhances fitness; but also imply that it is, in a sense, speculative, as the knowledge of the environment need not be immediately useful, which again highlights the connection of learning with, and the potential importance of fiction, itself a source of pleasure and knowledge (however concrete and accurate).

On the other hand, the drive to explore, motivated both adaptively and affectively, is mitigated by fear and risk avoidance. What is unseen is potentially dangerous in itself,[196] just as is being confused at something difficult to comprehend.[197] However, in analysing landscape preference, Kaplan made a striking observation that

> [t]he most preferred scenes tended to be of two kinds. They either contained a trail that disappeared around a bend or they depicted a brightly lit clearing partially obstructed from view by intervening

---

[195] Stephen Kaplan, "Environmental Preference in a Knowledge-Seeking, Knowledge-Using Organism," in: *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, eds. J.H. Barkow, L.Cosmides, J. Tooby (Oxford: Oxford University Press, 1992), p. 582.

[196] Thomas R. Herzog and Gregory Smith, "Danger, Mystery and Environmental Preference," *Environment and Behavior*, Vol.20, No.3 (May 1988), p. 320-344.

[197] Kaplan, "Environmental Preference," p. 583.

> foliage. In both cases the scenes appeared to promise that more information could be gained by moving deeper into the depicted setting. This promise of additional information was tentatively labelled "Mystery."[198]

Thomas Herzog and Gregory Smith's study of environmental preferences, confirms that the presence of mystery is positively related to landscape preference because it allows for "greater exploration and useful knowledge."[199]

The presence of the secondary zone of alterity ensures that the newness of the setting not only affects the reader, who, after all, experiences it already at the initial stage of heterotopicity, but that it also affects the characters of the science fiction story. The promise of mystery, with its temptations and threats, with its allure of potentiality, is thus intensified which serves to heighten estrangement and to stimulate cognitive engagement with the text and the alterity which it contains.

Gordon Orians and Judith Heerwagen, in an article neighbouring Kaplan's in *The Adapted Mind,* elaborate further that an optimal landscape would have to be easy enough for an individual to "read" and comprehend, yet would have to be sufficiently rich in "Mystery" not to appear boring.[200] A science fiction setting, due to its default alternativeness, will always provide such a landscape; it will never be completely known beforehand. Yet, according to Damien Broderick, science fiction "is marked [...] by the foregrounding of icons and interpretative schemata from a collectively constituted generic "mega-text."[201] This foregrounding immediately allows to mark off and recognise a science fiction text for what it is, thus allowing for at least a partial comprehension or orientation, balancing out the unknown factors

---

[198] Stephen Kaplan, "Aesthetics, Affect and Cognition. Environmental Preference from an Evolutionary Perspective," Environment and Behavior, Vol.19, No.1 (January 1987), p. 8.

[199] Herzog and Smith, "Danger, Mystery and Environmental Preference," p. 321.

[200] Gordon Orians and Judith Heerwagen, "Evolved Responses to Landscapes," in: The Adapted Mind: Evolutionary Psychology and the Generation of Culture, eds. J.H. Barkow, L.Cosmides, J. Tooby (Oxford: Oxford University Press, 1992), p. 555-580.

[201] Damien Broderick, Reading by Starlight. Postmodern Science Fiction (London and New York: Routledge, 1995), p. 157.

so as to reach a form of cognitive equilibrium implicit in Suvin's discussions of estrangement and cognition.

A fictional environment organised around the principles of mystery, novelty and complexity arouses interest. It brings with itself the possibility, implicit in its "mystery" aspect, of being rich in what James Gibson calls "affordances": action possibilities within the environment which the actor has to perceive in order to make their experience of the world meaningful.[202] Affordances exist even when not perceived as they are objective features of the world. However, when perceived, comprehended and interpreted by the observer, they not only offer possibilities of action, but, as Hubert Dreyfus and Sean Kelly argue, can become solicitations to act:

> To say that the world solicits a certain activity is to say that the agent feels immediately drawn to act a certain way. This is different from deciding to perform the activity, since in feeling immediately drawn to do something the subject experiences no act of the will. Rather, he experiences the environment calling for a certain way of acting, and finds himself responding to the solicitation.[203]

According to what was argued before, for science fiction the general solicitation is to perform mental experimentation, regardless of the actual topical focus of a given text. However, because of the ubiquity of the narrative pattern of spatial exploration, there emerges the possibility of a reciprocal relation, in which fictional texts serve to reinforce the innate, evolved drive.

Indeed, science fiction foregrounds it quite unabashedly. The opening narration of *Star Trek*, which for half a century has pledged to "boldly go where no man has gone before,"[204] might be the most famous example of this mechanism, and yet, the awareness of the importance of the exploration impulse, along with the

---

[202] James J. Gibson, *The Ecological Approach to Visual Perception* (New York: Psychology Press, 1986), p. 127.

[203] Hubert Dreyfus and Sean Kelly," Heterophenomenology: heavy-handed sleight-of-hand," Phenomenology and the Cognitive Sciences, 1 (2007), p. 52.

[204] Gene Roddenbery, opening narration, *Star Trek* (NBC, September 8, 1966).

recognition of the implied risk inherent in it, has been present in science fiction since its inception. Verne's Professor Arronax recognised it as early as 1870 saying: "I want to observe the full series of these wonders gathered under the seas of our globe. I want to see what no man has seen yet, even if I must pay for this insatiable curiosity with my life!"[205]

H.G. Wells' Mr. Bedford of *The First Men in the Moon* is less assured in his determination, but during a moment of contemplation recognises the imperative drive and its innateness :

> Why had we come to the moon? The thing presented itself to me as a perplexing problem. What is this spirit in man that urges him for ever to depart from happiness and security, to toil, to place himself in danger, to risk even a reasonable certainty of death? It dawned upon me up there in the moon as a thing I ought always to have known, that man is not made simply to go about being safe and comfortable and well fed and amused. Almost any man, if you put the thing to him, not in words, but in the shape of opportunities, will show that he knows as much. Against his interest, against his happiness, he is constantly being driven to do unreasonable things. Some force not himself impels him, and go he must.[206]

For a writer as characterised by his characters' bravado as Robert A. Heinlein, the temptation of the unknown space beyond the limits of the recognisable and established, was a defining feature of man. In the final lines of *Methuselah's Children*, the protagonist, Lazarus Long, declares:

> "There ought not be anything in the whole universe that man can't poke his nose into – that's the way we're built and I assume that there's some reason for it."
> "Maybe there aren't any reasons."
> "Yes, maybe it's just one colossal big joke, with no point to it. […] But I can tell you this, Andy, whatever the answers are, here's one monkey that's going to keep on climbing and looking around him to see what he can see, as long as the tree holds out."[207]

---

[205] Jules Verne, *20,000 Leagues Under the Seas*, Project Gutenberg, accessed 20 March, 2014, https://www.gutenberg.org/files/2488/2488-h/2488-h.htm.

[206] H.G. Wells, *The First Men in the Moon* (Oxford: Oxford University Press, 1995 [1901]), p. 141.

[207] Robert A. Heinlein, *Methuselah's Children* (New York: New American Library,1960[1958]), p. 160.

The opening of a new space can be a monumental act, larger than a single individual's personal journey, possibly of species-wide importance and with cosmic consequences. The protagonist of Ray Bradbury's short story „The Strawberry Window," a Martian colonist (the colony being another heterotopic space), realises this profundity. He starts with the recognition of how deep seated the drive to explore is:

> „I believe in Mars" he began quietly. ' I guess I believe some day it'll belong to us. We'll nail it down. We'll settle in. We won't turn tail and run. It came to me one day a year ago, right after we first arrived. Why did we come? I asked myself. Because, I said, because. It's the same year with salmon every year. The salmon don't know why they go where they go, but they go, anyway. Up rivers they don't remember, up streams, jumping waterfalls, but finally making it to where they propagate and die, and the whole thing starts again. Call it racial memory, instinct, call it nothing, but there it is. And here we are.[208]

He realises however, that behind this seemingly irrationalthe impulse to go, there is the deepest possible motivation of all, the physical survival, not of an individual, a tribe, or a nation, but of the species itself:

> So here we are. And from Mars where? Jupiter, Neptune, Pluto, and on out? Right. *And on out.* Why? Some day the Sun will blow up like a leaky furnace. Boom – there goes Earth. But maybe Mars won't be hurt; or if Mars is hurt maybe Pluto won't be, or if Pluto's hurt, then where'll we be, our sons' sons, that is? […] Why, we'll be on some world with a number maybe; planet 6 of star system 97, planet 2 of system 99! So damn far off from here you need a nightmare to take it in! We'll be gone, do you see, gone off away and safe! And I thought to myself, ah, ah. So that's the reason we came to Mars, so that's the reason men shoot of their rockets. […] Let me finish; not to make money, no. Not to see the sights, no. Those are the lies men tell, the fancy reasons they give themselves. [...] But all the while, inside, something else is ticking along the way it ticks in salmon or whales, the way it ticks, by God, in the smallest microbe you want to name. And that little clock that ticks in everything living, you know what it says? It says get away, spread out, move along, keep swimming. Run to so many worlds and build so many towns that nothing can ever kill man. You see, Carrie? It's not just us come to Mars, it's the race, the whole darn

[208] Ray Bradbury, "The Strawberry Window," in: *The Day It Rained Forever* (London: Hart-Davis, 1959), p. 249.

> human race, depending on how we make out in our lifetime. This thing is so big I want to laugh. I'm so scared stiff of it.' […] It matters if Man with a capital M keeps going. There's nothing better than Man with a capital M in my books. I'm prejudiced, of course, because I'm one of the breed. But if there's any way to get hold of that immortality men are always talking about, this is the way—spread out—seed the universe. Then you got a harvest against crop failures anywhere down the line. No matter if Earth has famines or the rust comes in. You got the new wheat lifting on Venus or where-in-hell-ever man gets to in the next thousand years.[209]

Bob then embarks on a costly enterprise of bringing all of his family's belonging's (the furniture, the trinkets, even the front porch of the house) in order to literally make himself at home on Mars, to turn it into a version of Earth, to make the unfamiliar space familiar and controllable.

That such recreation of the known in the unknown is potentially dangerous is evidenced by Walter Miller Jr.'s *A Canticle for Leibowitz*. The novel repeats the pattern of venturing beyond the established heterotopic space, in this case the Abbey of the Order of Leibowitz (a pre-war engineer commited to the preservation of knowledge) and equates it with the opening of conceptual or intellectual spaces of scientific exploration, made forbidden by the post-nuclear war anti-scientist sentiment. In the first part of the novel Brother Francis stumbles upon and enters a pre-war fallout shelter. The scene is notable for its primordiality: the entrance to the shelter is a hole in the ground and „holes were often inhabited."[210] Francis pokes a stick into it first, to make sure that no obvious danger lurks inside. The simplicity (primitivism even) of that act parallels and reflects the condition of all exploratory efforts at this stage of the novel: the monks of the Abbey gather and collect all pre-war memorabilia, regardless of actual value, poking in the dark as it were, in the hopes of re-establishing a technological civilisation in some unspecified future.

---

[209] Bradbury, "The Strawberry Window," p. 251.

[210] Walter M. Miller, *A Canticle for Leibowitz* (New York, Bantam Books, 1961), p. 11

Francis' stab in the dark is a faithful moment as it sets of a chain of events leading to his journey across largely uncharted territory to meet the Pope and reconnect with what is left of the Church. This results in the canonisation of Leibowitz and the eventual rise of the Order as the leading force of scientific and technological progress. The gradual re-establishment of the knowledge system is paralleled by the gradual reconstruction of geographical links with the world outside the Abbey, which, in turn, is paralleled by the gradual reconstitution of political and economic structures.

The trap in the attempt to recreate the old systems in new spaces is that it does not lead to anywhere new, and thus it does not, in the long run, satisfy the drive to move on, explore and progress. Over a thousand years after Brother Francis' descent into the fallout shelter, the human civilisation is highly technological again, with extraterrestial colonies set up among the stars and yet Earth is at the brink of another nuclear war. One of the monks, Joshua, attributes this to a sense of frustration arising from humanity having reached a state of relative comfort and the ensuing stagnation:

> The closer men came to perfecting for themselves a paradise, the more impatient they seemed to become with it, and with themselves as well. They made a garden of pleasure, and became progressively more miserable with it as it grew in richness and power and beauty; for then, perhaps, it was easier for them to see that something was missing in the garden, some tree or shrub that would not grow. When the world was in darkness and wretchedness, it could believe in perfection and yearn for it. But when the world became bright with reason and riches, it began to sense the narrowness of the needle's eye, and that rankled for a world no longer willing to believe or yearn.[211]

[211] Miller, *A Canticle for Leibowitz*, p. 288.

In an act of „hope for the soul and substance of Man somewhere,"[212] the monks decide to send out their own starship, carrying the memorabilia and missionaries into the outlying colonies where

> there would be no Edens found out there, they said. Yet there were men out there now, men who looked up to strange suns in stranger skies, gasped strange air, tilled strange earth. On worlds of frozen equatorial tundra, worlds of steaming Arctic jungle, a little like Earth perhaps, enough like Earth so that Man might live somehow,by the same sweat of his brow. They were but a handful, these celestial colonists of Homo loquax nonnumquam sapiens, a few harassed colonies of humanity that had had small help from Earth thus far; and now they might expect no help at all, there in their new non-Edens, even less like Paradise than Earth had been. Fortunately for them, perhaps.[213]

The cyclical character of the novel underscores the principle that the only hope for humanity's survival is an incessant search for new spaces and new potentialities in a constant escape from settling in, becoming comfortable and stagnant.

If the range of exploration of space in *A Canticle for Leibowitz* was limited to a few fledgling human colonies, Frank Herbert's *Dune* cycle focuses on the entirety of available space, quite literally. The central element of the first novel in the cycle, *Dune*, is a successful rebellion led by Paul Atreides against the Padishah Emperor, the ruler of the known universe and his Empire. The Empire is an old, rigid, quasi-feudal structure, regulated by countless customs, traditions, laws and rules. It is also extremely anachronistic: swords and fencing coexist with interplanetary travel and galaxy-wide commercial and technological companies coexist with powerful religious orders which rule through deliberate planting of superstition. The Empire is, in other words, organised along heterotopic principles. Paul himself is a wild card, the unpredicted result of a breeding programme whose aim was to create a Messiah, a being able to cross all of time and space at once.

---

[212] Miller, *A Canticle for Leibowitz*, p. 264

[213] Miller, *A Canticle for Leibowitz*, p. 287.

While the initial rebellion is apparently successful, it soon becomes obvious that the removal of the Padishah's empire leads only to its replacement by the Atreides empire, which is just as bureaucratic and stagnant. Paul knows what the way out of the rigidity is, but is unwilling to take it, and the task is taken up by his son, Leto, who undergoes a physical transformation disfiguring him, but ensuring his near immortality in the process. Leto, who commands absolute powers of prescience, and is nearly impervious to damage (except for drowning) then proceeds to enslave humanity to an unprecedented degree: he becomes God-Emperor, in absolute control of anything that happens; he dissolves the instistutions of the old empire, supplanting them with his own or directly with himself. No rebellion, no act of disobedience is possible against him. For thousands of years all dissenting or independent impulses of humanity are suppressed. When Leto finally falls, his death the only thing in all of time which avoided predicting, humanity explodes into the universe:

> When I set out to lead humankind along my Golden Path. I promised them a lesson their bones would remember. I know a profound pattern which humans deny with their words even while their actions affirm it. They say they seek security and quiet, the condition they call peace. Even as they speak. they create the seeds of turmoil and violence. If they find their quiet security. they squirm in it. How boring they find it. Look at them now. Look at what they do while I record these words. Hah! I give them enduring eons of enforced tranquility which plods on and on despite their every effort to escape into chaos. Believe me, the memory of Leto's Peace shall abide with them forever. They will seek their quiet security thereafter only with extreme caution and steadfast preparation. [214]

For the sake of the species' survival Leto makes the ultimate sacrifice: he banishes himself to eons of solitude, he denies himself happiness of any form, he makes sure that he remains feared and hated for all time. And yet, the scattering of humanity following his death results in the ultimate opening of literal and metaphorical spaces:

---

[214] Frank Herbert, *God Emperor of Dune* (New York: Putnam, 1981), p. 187.

the spread of humanity causes the development of enough cultural, political and physical diversity to ensure its continuous survival.

Conclusion

There is just as much conceptual distance between poking a stick into a hole in the ground and orchestrating a galaxy-wide eugenic programme as there is literary distance between Bradbury's short story and Herbert's massive cycle of epic novels. However, that the writings of a Heinlein or a Ballard should rely on so similar a pattern of opening up a heterotopic space through the basic act of physical exploration into a form of the unknown paraspace, and that this pattern should so closely reflect and correlate with the evolutionary structures and functions of landscape exploration is symptomatic. Science fiction not only draws on the evolutionarily seated notion that exploration is important; it perpetuates it in the form of an ubiquitous, meta-narrative pattern and in doing so it provides cultural reinforcement of a biological, adaptive impulse (which of course gave rise to the creation of the cultural pattern in the first place).

In reality, exploration, while always involving an element of risk, may prove to be uneventful or beneficial. In science fiction it has to lead to an encounter with otherness, the centrality of which has been repeatedly stressed. The following chapter focuses on mechanisms of creating the alien element and employing it in ways which enable it to become the object of cognitive attention.

CHAPTER 4: ALL THE STRANGE, STRANGE CREATURES: DISGUST AND THE SCIENCE FICTION NOVUM

> "I've been a tiger all my life. I trained myself… educated myself, pulled myself up by my stripes to make me a stronger tiger, with a longer claw and a sharper tooth… quick and deadly."
> "And you are. You are. The deadliest."
> "No. I'm not. I went too far. I went beyond simplicity. I turned myself into a thinking creature. I look through your blind eyes, my love whom I loathe, and I see myself. The tiger's gone."
>
> Alfred Bester, *The Stars My Destination*

The distinguishing feature of the exploration impulse is that it is pervasively transgressive. The basic act of entering an unknown territory necessarily involves a crossing of the threshold between what is known, explored and mapped and what is not. The act of the crossing itself always leads the subject into a space of contingency and of potentiality. It is a space of uncertainty, equally fraught with danger and opportunity, tempting and threatening at the same time.

In science fiction, regardless of the actual representation of the crossing, whether it is an actual, physical act of moving somewhere, or a more conceptual or figurative form of movement, the subject always enters into a different system of meanings, an unknown ontology, perpetually subversive of the empirically experienced, and perhaps expected, reality. Thus, there emerges a duality of transgressiveness: while the exploring subject is itself an invader, a transgressor, they become exposed to encounters with radical alterity occupying the space outside of the margins of the known: objects, beings, concepts, rules, laws and values which, by definition, breach or violate the established rules of established orders, be they scientific, political or social. These alien elements, while threatening and invasive,

always remain the focus of attention, interest and even fascination. Contact with the unknown, in the words of Istvan Csicsery-Ronay Jr.

> represents the collapse of ontological categories that reason has considered essentially distinct, creating a spectacle of impossible fusions. This is the domain of monstrous aliens, interstitial beings, and anomalous physical phenomena. [...] [it] is implosive, accompanied by fascination and horror at the prospect of intimate category violating phenomena discovered by human science.[...] This facet, one of the most powerfully attractive of the genre, draws its reason-based irrationality increasingly from actual scientific innovations that combine phenomena previously held to be naturally distinct (such as, for example, genetic engineering, molecular computing, and Artificial Life) and the constant weakening of category boundaries that seems to menace the sense of personal identity.[215]

Besides the inherent dialectic of fascination and horror arising from the violating character of science fictional alterity, Csicsery-Ronay Jr. observes another duality inherent in the encountered novum:

> Each sf novum is a compound of at least two different kinds of radical change. The change usually first appears as a physical-material novelty: change in the material organization of existence. This form is complemented by an ethical novelty: a change in values and mores. The genre does not dictate how the two dimensions will be related in a given text, only that they will be. Ethical themes may constrain the material novum, overdetermining it with symbolic qualities [...]. Or, vice versa, the material novum may set the conditions for the ethical, determining the possibilities of judgment.[...]. Many variations are possible. In sf, the physical-material and the ethical are distinct realms, but they rub shoulders at the molecular level.[216]

From the narrative perspective the representation of the novum is a practical problem. For the astrophysicist and science fiction author Gregory Benford "[t]here is probably no more fundamental theme in science fiction than the alien. The genre reeks of the desire to embrace the strange, the exotic and unfathomable nature of the future. Often the science in SF represents *knowledge*—exploring and controlling and

---

[215] Istvan Csicsery-Ronay Jr., *The Seven Beauties of Science Fiction* (Middletown: Wesleyan University Press, 2008), p. 7.

[216] Csicsery-Ronay Jr., *The Seven Beauties of Science Fiction*, p. 56.

semisafe. Aliens balance this desire for certainty with the irreducible unknown [...] Yet for me, the most interesting problem set by the alien is in rendering the alienness of it. How do you set the ineffable in a frame of scientific concreteness? This is a central problem for SF."[217] Benford further notes that "one cannot depict the totally alien,"[218] or as Patrick Parrinder phrases it:

> any meaningful act of defamiliarization can only be relative, since it is not possible for man to imagine what is utterly alien to him. To give meaning to something is also, inescapably, to 'humanize' it or to bring it within the bounds of our anthropomorphic world view. This means that we can only describe something as 'alien' by contrast or analogy with what we already know."[219]

I wish to propose that these incongruous, binary relationships between familiarity and aliennes, invasive transgressiveness and attractiveness, as well as between materiality and ethicality, are negotiated through, governed by and built upon the logic and mechanics of disgust and disgust responses and, because of the complex nature of that emotion, by its correlate experience of curiosity. Disgust is the main mechanism protecting the body from danger inherent in the transgression of its boundaries and, as research shows, it operates equally powerfully in the social and cultural spheres. I wish to argue that it is disgust which provides the necessary frame of reference against which, and through which, alienness can be rendered. To support this claim I will discuss the evolutionary structure of disgust as it is currently understood and then present how it influences the narrative patterns of science fiction.

---

[217] Gregory Benford, "Effing the Ineffable," in: *Aliens. The Anthropology of Science Fiction*, eds. George S. Slusser and Eric S. Rabkin (Carbondale and Evansville: Southern Illinois University Press, 1987), p. 24.

[218] Benford, "Effing the Ineffable," p. 25.

[219] Patrick Parrinder, "The Alien Encounter: Or, Ms Brown and Mrs Le Guin," *Science Fiction Studies*, Vol.6, No.17 (1979), accessed 26 October, 2014, http://www.depauw.edu/sfs/backissues/17/parrinder17.htm.

Disgust

In its physiological dimension, disgust is primarily a food rejection system. According to Charles Darwin "[t]he term 'disgust,' in its simplest sense, means something offensive to the taste. It is curious how readily this feeling is excited by anything unusual in the appearance, odour, or nature of our food."[220] Darwin points out that the food in question need not be actually rotten or otherwise harmful; it is enough for it to be "unusual" or "not commonly eaten"[221] and that the "mere idea" of ingesting such food is enough to elicit disgust: no actual presence of it is required. Furthermore, he observes an interesting dependency: "A smear of soup on a man's beard looks disgusting, though there is of course nothing disgusting in the soup itself. I presume that this follows from the strong association in our minds between the sight of food, however circumstanced, and the idea of eating it."[222] Even these early remarks already hint that disgust, even though based in a food-rejection response, can be experienced in the ideational and imaginary spheres.

Current research supports and further develops Darwin's contentions. In their chapter on disgust included in the 3rd edition of *the Handbook of Emotions*, Paul Rozin, Jonathan Haidt and Clark R. McCauley propose a complex typology of disgust based on its biological and cultural evolution. To explain the various transformations and extensions of disgust they rely on the concept of preadaptation. According to Ernst Mayr, preadaptation is a critically important process by means of which an existing evolved structure assumes "a new function without interference

[220] Charles Darwin, *The Expression of the Emotions in Man and Animals* (Cambridge: Cambridge University Press, 2009 [1890]), p. 269 .
[221] Darwin, *The Expression of the Emotions*, p. 270.
[222] Darwin, *The Expression of the Emotions*, p. 269.

with the original function."[223] Stephen Jay Gould and Elisabeth Vrba, while agreeing with the importance of the process, propose that the term "exaptation" be used to refer to it. They elaborate:

> We suggest that such characters, evolved for other usages (or for no function at all), and later coopted for their current role be called *exaptations*. They are fit for their current role, hence *aptus*, but they were not designed for it, and are therefore not *ad aptus*, or pushed towards fitness. They owe their fitness to features present for other reasons and are therefore *fit (aptus) by reason of (ex)* their form, or *ex aptus*. Adaptations have functions; exaptation have effects.[224]

The process also operates in the developmental realm, where "[s]ystems evolved to handle specific problems in the world can be accessed in development to handle other types of problems."[225] It is this flexibility that allows the base emotion of disgust to operate on a number of levels, starting from the purely physiological and reaching well into the ethical and moral.

The origin of all disgust is, according to Rozin, Haidt and McCauley, "the rejection response to bad-tasting foods."[226] It is a basic response, present in human infants and mammals, triggered either by innate or acquired distastes[227] and Rozin is careful to distinguish it from disgust proper.[228] While on the output side the distaste and disgust systems might appear similar, sharing the physiological and behavioural responses (drooling, wrinkling of the nose etc.), disgust has a much broader range of

---

[223] Ernst Mayr, *Evolution and the Diversity of Life. Selected Essays* (Cambridge: Harvard University Press, 1976) p. 100.

[224] Stephen Jay Gould and Elisabeth Vrba, "Exaptation – A Missing Term in the Science of Form," Paleobiology, Vol.8, No.1 (1982), p. 6.

[225] Paul Rozin, "Towards a Psychology of Food and Eating: From Motivation to Module to Model to Marker, Morality, Meaning and Metaphor," *Current Directions in Psychological Science*, Vol. 5, No.1 (1996), p. 20.

[226] Paul Rozin, Jonathan Haidt and Clark R. McCauley, "Disgust," in: *Handbook of Emotions 3rd Edition*, eds. Michael Lewis, Jeanette Haviland-Jones and Lisa Feldman Barret (New York and London: The Guilford Press, 2008), p. 764.

[227] Rozin, Haidt, McCauley, "Disgust," p. 765.

[228] Rozin, Haidt, McCauley, "Disgust," p. 759.

possible elicitors, all of which, however, are centred around the main protective function.

This function is evident in what Rozin et al. understand as "core disgust": still focused on the oral sphere, but differing from the distaste response in that it is a system of rejection of potentially dangerous, offensive or otherwise contaminant food.[229] Unlike in the case of distaste, the disgusting food need not have negative sensory properties.[230] The prospect of the food having been contaminated in some way, particularly by contact with body waste and animals, is enough to make it disgusting.[231] The focus on the oral sphere is due to the mouth's role as one of the primary points of entry into the body, and concerns primarily things that could be ingested and incorporated into the self through the mouth and prove to be poisonous or otherwise contaminant.

Apart from certain foods, disgust elicitors include body products, inappropriate sexual acts (such as incest or bestiality), body-envelope violations (such as deformity), poor hygiene and contact with death.[232] As these are all potential sources or routes of infection and contamination, "core disgust" is expanded to include the whole of the body and it becomes a defence mechanism for parts of it other than the mouth: the nose, the skin, the eyes, that is the outlying extremities which serve as entry-points through which the transgression of the body's boundaries and the violation of its margins can take place.

Crucially, among the most powerful disgust elicitors are animals and their products. Based on their research using questionnaires and interviews Rozin and

---

[229] Rozin, Haidt, McCauley, "Disgust," p. 759.

[230] Paul Rozin and April Fallon, "A Perspective on Disgust," *Psychological Review,* Vol.94, No.1 (1987), p. 24.

[231] Rozin and Fallon, "A Perspective on Disgust," p. 27.

[232] Rozin, Haidt, McCauley, "Disgust," p. 757. See also: Jonathan Haidt et al., "Body, Psyche and Culture: The Relationship Between Disgust and Morality," *Psychology and Developing Countries*, Vol. 9, No.1 (1997), p. 112.

Fallon firmly claim in their 1987 paper "A Perspective on Disgust" that "almost all objects that qualify as disgusting by our criteria are animals or parts of animals, animal body products, or objects that have had contact with any of the above or that resemble them."[233] It is so mainly because animals are, or are perceived to be, potential sources of infection, as many kinds of them come in contact with feces, rotting flesh or other waste.[234] Correlate to disgust with animals is disgust with "crawling and swarming part full of (repulsive) excess of life"[235] identified by Aurel Kolnai as early as 1929.

The food rejection aspect of disgust puts the omnivorous *homo sapiens* in a precarious position referred to as the "omnivore's dilemma": on the one hand it is beneficial to try new foods, yet on the other hand such exploration is either unpleasant or dangerous. Similarly, animal based foods are the most valuable in terms of nutrition, yet at the same time are among the most disgusting.[236] The logic and dynamics of disgust is thus a logic and dynamics of paradoxical tension in which choices have to be made and trade-offs have to happen. The "omnivore's dilemma" is clearly similar to what now could be called "the explorer's dilemma", and to what forms the crux of science fiction: the tension between the threatening and the fascinating.

More interestingly, however, this second-level disgust is symbolically extended to respond "to any evidence that our bodies are no different than animal

---

[233] Rozin and Fallon, "A Perspective on Disgust," p. 27.

[234] Rozin and Fallon, "A Perspective on Disgust," p. 29.

[235] Aurel Kolnai, "Der Ekel," given in: Winfired Menninghaus, *Disgust. The Theory and History of a Strong Sensation*, trans. Howard Eiland and Joel Golb (Albany: State University of New York Press, 2003), p. 18. See also:

[236] Rozin and Fallon, "A Perspective on Disgust," p. 27. See also: Paul Rozin, "Selection of Food by Rats, Humans and Other Animals," in: *Advances in the Study of Behavior*, ed. Jay S. Rosenblatt (New York: Academic Press, 1976), p. 23.

bodies."[237] Anything which reminds humans of their essential animal-nature, "our animal vulnerability"[238] to injury and death, of our being not unique after all, not elevated above animals, is considered disgusting and has to be suppressed. The animal-origin disgust serves to "keep human animalness out of awareness."[239] This involves the regulation of physiological activities such as excretion, eating and having sex, but also the maintenance of grooming and hygiene standards. While particular rules differ significantly between cultures, the failure to obey them elicits disgust and places the offender below the status of a human. At this stage, by denying similarity with animals, this form of disgust becomes not only the guardian of the "human soul,"[240] or of the human conviction of their superiority over nature, but also of normative behavioural systems.

The effect is the moralisation of disgust. Moral disgust often does not include a corporeal element at all. While sometimes it is triggered by the images of the abuse or violation of the body, often the elicitors are purely ideational, contextual, violations of purity, sacredness, fairness, or justice [241]:

> In these cases a person disrespects the sacredness of God, or causes impurity or degradation to himself/herself, or to others. To decide if an action is wrong, you think about things like sin, the natural order of things, sanctity, and the protection of the soul or the world from degradation and spiritual defilement.[242]

[237] Rozin, Haidt, McCauley, "Disgust," p. 764.

[238] Rozin, Haidt, McCauley, "Disgust," p. 761.

[239] Rozin, "Towards a Psychology of Food and Eating," p. 22.

[240] Rozin, Haidt, McCauley, "Disgust," p. 763.

[241] Paul Rozin, Jonathan Haidt, Katrina Fincher, "From Oral to Moral," *Science*, Vol. 323 (2009), p. 1180.

[242] Rozin et al., "The CAD Hypothesis: A Mapping Between Three Moral Emotions (Contempt, Anger Disgust) and Three Moral Codes (Community, Autonomy, Divinity), *Journal of Personal and Social Psychology*, Vol.76, No. 4 (1999), p. 576.

Research shows that violations of fairness actually activate the same parts of the brain that are activated by "core disgust,"[243] that is, when people refer to an idea as being disgusting they are not being merely metaphorical but are describing a genuine physiological reaction. This confirms the link between trangressive marginal bodily experience and ideational systems pointed out by the structural anthropologist Mary Douglas:

> all margins are dangerous. If they are pulled this way or that the shape of fundamental experience is altered. Any structure of ideas is vulnerable at its margins. We should expect the orifices of the body to symbolise its specially vulnerable points. Matter issuing from them is marginal stuff of the most obvious kind. Spittle, blood, milk, urine, faeces or tears by simply issuing forth have traversed the boundary of the body. So also have bodily parings, skin, nail, hair clippings and sweat. The mistake is to treat bodily margins in isolation from all other margins. There is no reason to assume any primacy for the individual's attitude to his own bodily and emotional experience, any more than for his cultural and social experience.[244]

Rozin's et al. description of moral disgust also confirms the conclusions Douglas drew from her analysis of Leviticus that "[h]oliness is exemplified by completeness. Holiness requires that individuals shall conform to the class to which they belong. And holiness requires that different classes of things shall not be confused."[245] Whatever violates the boundaries of categorisation becomes impure and disgusting: "[h]ybrids and other confusions become abominated."[246]

There is an interesting reciprocality of moralization emergent: acts that are morally impermissible are considered disgusting, but also behaviours or individuals which are considered disgusting become morally unacceptable. As William Ian

---

[243] See: Alan Sanfey et al. " The Neural Basis for Economic Decision Making in the Ultimatum Game," *Science*, Vol. 300 (2003).

[244] Mary Douglas, *Purity and Danger. An Analysis of Concepts of Pollution and Taboo* (London and New York: Routledge, 2001 [1966]) p. 122.

[245] Douglas, *Purity and Danger*, p. 54.

[246] Douglas, *Purity and Danger*, p. 54.

Miller observes, commenting on Darwin's example of the man with soup in his beard:

> The soup on the beard reveals the man as already contaminated by a character defect, a moral failure in keeping himself presentable in accordance with the righteously presented demand that he maintain his public purity and cleanliness of person and not endanger us by his incompetence. It needn't have been soup or bread crumbs that incriminated him; it could just as well have been bits of lint or even soap residue. No doubt, however, the soup would be more disgusting than either lint or soap. The soup, after all, unlike lint or soap, might have fallen onto his beard from his mouth or from a spoon that had already been in his mouth. It is thus not our fear of oral incorporation that makes the soup disgusting to us but his failure to have properly orally incorporated it.[247]

While the particular elicitors of this kind of disgust will certainly be culturally defined and thus will vary considerably between cultures, moral disgust responses will serve to strengthen and protect the cultural and moral systems themselves. Rather than being merely a food rejection mechanism, disgust assumes the role of a socio-cultural system of exclusion.

There are two observations which bear directly on the relevance of this precession from "oral to moral" to the analysis of the science fiction nova. Firstly, in fits of what Rozin terms "benign masochism,"[248] disgust elicitors are sometimes actively sought out and when perceived in contexts that are considered safe, where there is little to no risk of contamination, often become sources of amusement or humour.[249] Other negative emotions, such as fear and sadness, and their elicitors, are also sought. Rozin attributes this tendency to the experience of pleasure derived from suppressing the bodily response, proving that the mind does indeed rule over the body and is able to overcome or suppress its reactions to disagreeable stimuli.[250]

---

[247] William Ian Miller, *The Anatomy of Disgust* (Cambridge: Harvard University Press, 1997), p. 4.
[248] Rozin, "Towards a Psychology of Food and Eating," p. 24.
[249] Rozin. Haidt, McCauley, "Disgust," p. 770.
[250] Rozin, "Towards a Psychology of Food and Eating," p. 24.

Secondly, since disgust plays an important role in moralization and the establishment and enforcement of cultural norms and taboos across a very broad spectrum, its role of the ultimate anti-transgression emotion should now become clear. And since science fiction nova are radically non-normative, it is reasonable to expect them to be disgusting. This in turn allows for the dual character of the novum identified by Csicsery-Ronay Jr. to emerge: like objects of disgust the nova are simultaneously repulsive and attractive, and just like the objects of disgust they are simultaneously intensely physical while being ethically and morally charged. These inherent dualities make the nova avoid categorisation, which in turn reinforces their disgustedness thus closing the feedback loop of disgust.

There is also a certain parallelism between how the object of disgust is always in the centre of immediate attention, and how the novum, because of its strangeness and difference, demands and draws attention, too. For Colin McGinn,

> [d]isgust is, importantly, both an aversive *and* an attractive emotion. It repels us from its object, and this is surely its primary character, but it can also draw us to that object. The attraction can take various forms, and the combination of attraction with repulsion can be complex and subtle. […] Death and feces have their fascination for the human psyche, in the teeth of their repugnance - as do disease, injury, deformity, and other disgust-inducing conditions. Here is where the notion of "morbid fascination" comes in – unhealthy curiosity, sticking your nose where it doesn't belong. People find themselves mesmerized by the dead body, drawn to it against their will, even as their stomach turns queasy. The bloody car accident invites the prolonged stare, along with the heaving of the innards. Even a pile of dung, human or animal, carries its quantum of fascination – so intimate, so elemental, so curiously assertive. We have to stop and look – a momentary sniff might even be indicated. Then we turn abruptly away – only to turn back after a calming interval. The disgusting exerts its demonic pull, even as it thrusts us away. We feel conflicted, confused, and disturbed. [...] There is, after all, something exciting about the disgusting, something beyond the humdrum: the disgusting is stirring, vital. Disgust sticks in the memory and vivifies the senses, even when – especially when – it is deemed most repellent. Disgust is not boring. It has a kind of negative glamour. [...] And the human psyche is drawn to the

> interesting and exceptional – the charged object, with its magical potency. We are stunned at our capacity to be convulsed by the disgusting object; we marvel at its strange power. All this is compatible with feelings of intense revulsion.[251]

This paradoxical character of disgust makes it a very effective means of both evoking estrangement and stimulating cognition to the point that the relation between disgusting physicality, negative moral evaluation and the insistent drawing of attention to the novum in order to centralise it and thus ensuring that it is the object of mental experimentation can be identified as a permanent feature of science fiction. Virtually all types and sub-types of science fiction narratives, from alien-invasion stories and space-operas to cyberpunk and techno-thrillers rely on it for representing their respective nova.

The Estranging Disgustedness of the Alien

Among alien-contact narratives, perhaps none is as iconic and well-known as H.G. Well's *The War of the Worlds*. The physical description of the Martian invaders leaves little doubt as to how their alienness is rendered:

> I think everyone expected to see a man emerge – possibly something a little unlike us terrestrial men, but in all essentials a man. I know I did. But, looking, I presently saw something stirring within the shadow: greyish billowy movements, one above another, and then two luminous disks – like eyes. Then something resembling a little grey snake, about the thickness of a walking stick, coiled up out of the writhing middle, and wriggled in the air towards me – and then another. A sudden chill came over me. […] A big greyish rounded bulk, the size, perhaps, of a bear, was rising slowly and painfully out of the cylinder. As it bulged up and caught the light, it glistened like wet leather. Two large dark-coloured eyes were regarding me steadfastly. The mass that framed them, the head of the thing, was rounded, and had, one might say, a face. There was a mouth under the eyes, the lipless brim of which quivered and panted, and dropped saliva. The whole creature

[251] Colin McGinn, *The Meaning of Disgust* (Oxford: Oxford University Press, 2011), p. 48.

> heaved and pulsated convulsively. A lank tentacular appendage gripped the edge of the cylinder, another swayed in the air.
>
> Those who have never seen a living Martian can scarcely imagine the strange horror of its appearance. The peculiar V-shaped mouth with its pointed upper lip, the absence of brow ridges, the absence of a chin beneath the wedgelike lower lip, the incessant quivering of this mouth, the Gorgon groups of tentacles, the tumultuous breathing of the lungs in a strange atmosphere, the evident heaviness and painfulness of movement due to the greater gravitational energy of the earth – above all, the extraordinary intensity of the immense eyes – were at once vital, intense, inhuman, crippled and monstrous.
>
> There was something fungoid in the oily brown skin, something in the clumsy deliberation of the tedious movements unspeakably nasty. Even at this first encounter, this first glimpse, I was overcome with disgust and dread.[252]

The Martian engages the whole spectrum of physiological disgust: it clearly secretes something through its skin, which, additionally is covered with something fungoid – a possible source of infection. It is betentacled, its face is at most tentatively recognisable, the shape of the eyes and mouth, the two critically important marginal areas, is wrong, even its breathing is different: these elements all violate the body-envelope dimension of disgust. The only way for the Narrator to describe it is by animal oriented similes. At the same time, however, the Martian is "vital and intense," it is the excess of the organic, an overbearing physical presence which is not only novel but incomprehensible and unrecognisable. The physical repugnance of Martians is paralleled by their efficient and comprehensive cruelty against humans. With all of their intensity, the Martians violate and up-turn all categories of order at all levels, from the personal breakdown of the Narrator towards the end of the story, through the invasion and transformation of the countryside to the effective collapse of the British Empire with its political and cultural systems.

---

[252] H.G. Wells, *The War of the Worlds*, Project Gutenberg, accessed 20 March, 2014, https://www.gutenberg.org/files/36/36-h/36-h.htm (1898).

The Martians themselves fall prey to contamination, as the end of their invasion is caused by germs. The Martians are:

> slain by the putrefactive and disease bacteria against which their systems were unprepared; slain as the red weed was being slain; slain, after all man's devices had failed, by the humblest things that God, in his wisdom, has put upon this earth. there are no bacteria in Mars, and directly these invaders arrived, directly they drank and fed, our microscopic allies began to work their overthrow. Already when I watched them they were irrevocably doomed, dying and rotting even as they went to and fro. It was inevitable.[253]

The story resolves its conflict through what amounts to food poisoning, a body-envelope violation brought about by insufficient discrimination in food selection, the very basis of all disgust. Through this, the novel is able to deliver its politically and socially charged message that while "humans are threatened by aliens embodying the technological power and ruthlessness of a future race," that race is "a race representing man's intelligence dehumanized."[254]

Alien invasion narratives appear to be particularly prone to this kind of politicising and moralising. In Robert Heinlein's 1951 *The Puppet Masters*, the physical appearance of the alien invaders, the Masters, is also repulsive. They are "[g]rayish, faintly translucent, and shot through with darker structure, shapeless - it reminded me of a giant clot of frogs' eggs. It was clearly alive, for it pulsed and quivered and moved by flowing."[255] The Masters are parasites, attaching themselves to human hosts and taking over control of their bodies and minds. The body boundary violation is accompanied by the violation of human autonomy, individuality and the principle of self-determination.

In Jack Finney's 1955 novel *The Body Snatchers* the aliens are plant-like seed-pods which replace people with physical duplicates, destroying the originals.

---

[253] Wells, *The War of the Worlds.*

[254] Kenneth V. Bailey, "Aliens for the Alienated," in: *Storm Warnings. Science Fiction onfronts the Future*, ed. George Slusser (Carbondale: Southern Illinois University Press, 1987), p. 205.

[255] Robert A. Heinlein, *The Puppet Masters* (New York: Ballantine Books, 1986 [1951]), p. 18.

Ideationally, the aliens threaten to eliminate human emotions: hope, excitement, ambition, love. Much like the Masters of Heinlein's novel, they offer to bring humanity peace at the price of the ability to experience emotion, and are rejected on much the same grounds: the surrender of the ability to experience emotion is a fundamental violation of what decides the uniqueness of mankind. The emotions the aliens promise to eradicate are precisely those which distinguish man from animals. Giving them up would be a debasing, animalising act, and the perspective of it causes an immediate rejection reaction.

And yet, despite the heavy moral and political charging of the invasion-narratives, their aliens have the potential to elude easy politicisation. According to Carl Malmgren it is possible to distinguish between extrapolative and speculative science fiction. Speculation involves a "quantum leap of imagination toward an other state of affairs."[256] A speculatively generated alien, because of its strangeness, is "unknowable"[257] and due to this

> transgresses basic characterological norms [...] These alien actants explore the limitations of being human and suggest the possibility of transcending those limits. They examine what we are not, in so doing intimating what we could become. Any attempt to naturalize them, to humanize them, fails, since they encode a degree of excess, an "essential strangeness," that cannot finally be mastered. The speculative encounter resists readerly recuperation; it presents itself as an experience to be undergone, not a lesson to be learned.[258]

Such inexplicability is the defining feature of the alien visitors in Arkady and Boris Strugatskys' *Roadside Picnic*. The aliens themselves never appear in the novel, the only sign of their presence are the contaminated, closed off, paraspatial Visitation Zones, full of strange and dangerous phenomena. The disgustedness of the aliens is

---

[256] Carl Malmgren, "Self and Other in SF: Alien Encounters," *Science Fiction Studies*, Vol. 20, No.1 (1993), p. 17.
[257] Malmgren, "Self and Other in SF," p. 17.
[258] Malmgren, "Self and Other in SF," p. 17.

only manifested through the gruesome mutilations of the human stalkers who dare enter these Zones, but otherwise at the core of the alien presence lies conspicuous absence. This elusiveness opens the speculative alien to all the potentialities of interpretation. Unknowability and incomprehensibility manifested through disgust invite an intense effort of mental experimentation, thus making the encounter with such radical alterity cognitively satisfying even though no clear explanations are provided by the novel.

On the other end of the knowability spectrum, the long-running space opera show *Star Trek* employs the same mechanism for the generation of a different kind of aliens. The extraterrestrials which at various points of the show's history assume the role of villains are the excessively aggressive Klingons, the greedy and lecherous Ferengi and the treacherous Romulans. Emotionally and ethically these are one-dimensional, easily-read alien figures. Physically these aliens are decidedly humanoid, visually distinct from humans only through their modified facial features: pointy or oversized ears or teeth, extra brow ridges, cranial protrusions and similar prosthetic applications. Their anthropomorphism translates almost directly into their conceptual transparency, which in turn renders them much more cognitively approachable. In Malmgren's terms, aliens of such type are extrapolative, that is generated through "logical projection or extension of existing actualities."[259] Thus, the strangeness of anthropomorphic aliens is particularised. They are "mirrors" which offer "a way to examine our problems in a different light,"[260] which in terms open the possibility of highly concrete and contextualised cognitive experimentation.

Non-hostile or outright friendly aliens are not exempt from the disgust

[259] Malmgren, "Self and Other in SF," p. 17.

[260] Gregory Benford, "Aliens and Knowability: A Scientist's Perspective," in: *Bridges to Science Fiction*, ed. George Slusser et al. (Carbondale: Southern Illinois University Press, 1980), p. 54.

principle. In the original run of *Star Trek*, the science officer Mr Spock (a human-Vulcan hybrid, with vaguely Mephistophelian features, pointy ears and, apparently, green blood) and his coldly logical approach to problems and conflicts are contrasted with the more heartfelt and passionate responses of the chief medical officer, Dr McCoy, a pure human. McCoy's indignation at Spock's lack of emotion manifests itself through what amounts to almost casual racism. He frequently refers to his colleague as a "green-blooded son-of-a-bitch" and variations thereof (including "green-blooded half-breed," and "freak") linking Spock's physicality with him being "cold-blooded" and "inhuman."

Benign alienness is problematic. As John Huntington noted: „In imaginative literature, the phrase "friendly alien" becomes an oxymoron: the imagined friendly alien achieves its benignity by approaching the familiar and conventionally valued, that is, by not being truly alien. Such alienness is a superficial costume hiding a familiar personality."[261] The more recognisable, and hence the more acceptable, the alien is, the less alien it becomes. Yet, in order for science fiction to remain what it is, a sort of "conservation of alienness" has to take place. As Huntington puts it: "One alien can be accepted as benign only by discovering another creature which can absorb the xenophobic charge."[262] As this is realised through disgust-based rejection, the benignity of the alien must be balanced by the presence of an object which becomes the focus of physical or moral violation.

Huntington uses the example of *E.T. The Extraterrestrial* to illustrate the point. In the initial stages of the encounter the alien is misidentified as "an iguana" or "a pervert or a deformed kid or something," that is the human characters attempt to

[261] John Huntington, "Discriminating Among Friends: The Social Dynamics of the Friendly Alien," in: *Aliens. The Anthropology of Science Fiction*, eds. George S. Slusser and Eric S. Rabkin (Carbondale and Evansville: Southern Illinois University Press, 1987), p. 60.
[262] Huntington, "Discriminating Among Friends," p. 61

approach it cognitively in terms of categories of disgust elicitors: animals, moral infractions and bodily deformations. However, "as the alien gains our sympathy (by behaving in recognizably human ways), hostility is generated against such adult authorities as scientists and policemen,"[263] representing the highly normative systems which attempt to interfere with the characters doing what they understand to be morally right: saving the alien from the prospect of being physically violated by human scientists and restoring the order of things by returning E.T. where he belongs.

In the *Alien* film series, the Xenomorph is as physically disgusting and violating as possible: it oozes slime, bleeds acid, its reproductive cycle requires the presence of an orally penetrated host in which an embryo is deposited. The adult alien is hybridical as its DNA merges with that of the host. The birth of the Xenomorph is always fatal to the host, and the creature's entire life cycle consists of capturing more hosts and depositing more embryos. The graphic imagery of the films underscores the creature's physical transgresiveness as the human characters are repeatedly torn to pieces, impaled and impregnated by what amounts to being a nearly unstoppable, extremely invasive alien life form. Notably however, the Xenomorph, with all of its violations of the physical, does not violate any moral system, possibly because it does not have one of its own. It is clearly the antagonistic element of the films, yet it is not a villain. Instead, the "xenophobic charge" is, at least partly, shifted onto the Weyland-Yutani Corporation.

There emerges an interesting symmetry of disgust between the physically disgusting alien which is devoid of any motivational, value or moral systems other than the drive to survive and the company which stands behind all the tribulations

[263] Huntington, "Discriminating Among Friends," p. 61.

that befall the crews of the *Nostromo* and the *Sulaco,* perfectly willing to sabotage and sacrifice its employees, to expose them to infestation by an alien species in the name of profit and greed. Moral categorisations do not apply to the Alien, which allows the company's representative, the category-violating android Ash (itself made disgusting by the gushing of a sickly white fluid accompanying its demise) to admire its purity even though physically the Alien is anything but pure. The shifting of disgust is so effective as to lead Ripley to admit: "I don't know which species is worse. You don't see them fucking each other over for a goddamn percentage."[264]

Disgusting Technologies

The reliance on disgust in creating estrangement and, consequently, stimulating cognitive exploration through mental experimentation is also clearly visible in science fictional representations of technology. The logic operating here is almost exactly like the one inherent in the omnivore's dillemma, where the enthusiasm for potential benefits is mitigated by the awareness of the possible threats and regulated through the experience of disgust. The ambivalent emotional attitude towards technology, one of simultaneous fascination and terrified revulsion, present in so much of science fiction, closely parallels the ambivalent attitude towards the disgusting. Just as the disgusting is a violator, something out of its place, challenging and threatening the ordered structures, so is technology, which according to Walter McDougall is "always disruptive and creates a crisis for

[264] James Cameron, dir., *Aliens* (20th Century Fox, 1986).

culture."[265] The philosopher Carl Mitcham considers the problem of the "modern technological project" in terms of "uneasiness" which has been

> nourished [...] by the common experience of citizens of technological societies over the past four decades – as all of us have been forced in divisive circumstances to address ethical issues associated with nuclear weapons and power plants, developments in information technologies from telegraphs to computers, biomedical technologies, space exploration, technological disasters and environmental pollution. Emerging from human thought, they also challenge it, as becomes apparent almost immediately.[266]

Paradoxically, all the challenges, subversions and disruptions form a continuity. As Scott Bukatman noted in his *Terminal Identity*, following the technological and cultural periodizations of Ernest Mandel and Fredric Jameson, it is possible to establish a rough chronology of emergence of new technologies, from the advent of the Machine Age, through the Nuclear and Space Ages, to the Information Age, each epoch accompanied by a corresponding set of fears and anxieties, accumulating rather than superseding one another: "Nuclear anxieties continue to proliferate, while worries about the Machine are hardly obsolete for large parts of the population. Under postmodernity, these techno-anxieties commingle."[267]

Science fiction narrates this sense of uneasiness and disruption in a way which is itself disruptive, using fictional derivatives of the real-life technological changes in the form of postulated inventions, discoveries or developments, which, while always somehow related to the real-life phenomena, are at the same time placed outside, or beyond, the established scientific paradigms. Thus, the science fiction novum itself is always placed in the position of offending violation, of

---

[265] Walter A. McDougall, *…The Heavens and The Earth: A Political History of the Space Age* (Baltimore and London: The Johns Hopkins University Press, 1997), p. 12 .

[266] Carl Mitcham, *Thinking Through Technology. The Path Between Engineering and Philosophy* (Chicago and London: The University of Chicago Press, 1994), p. 1-2.

[267] Bukatman, *Terminal Identity*, p. 5.

challenging the margins of science and technology which themselves challenge the protective envelope of the established cultural systems.

The fundamental continuity of science fiction's focus on technology-related crises is reflected in the continuity of the presence of disgust. William Gibson's short story "The Gernsback Continuum," a radical literary manifesto, announcing a shift from the optimistic and enthusiastic style of science fiction emblematic of the "pulp era," towards a more gritty, visceral and even cynical attitude of cyberpunk, highlights the presence of this continuity. Gibson's endeavour to create a new style of science fiction writing arises, as he admitted in an interview with Larry McCaffery, from "an aesthetic revulsion"[268] towards the old paradigm. Gibson said that he "had a sense of what the expectations of the SF industry were in terms of product, but [he] hated that product and felt such a genuine sense of disgust that [he] consciously decided to reverse expectations, not give publishers or readers what they wanted"[269] and that sense of disgust is reflected in the short story.

The old, Gernsbackian, paradigm of science fiction is represented in the story by the "semiotic ghosts" of the past imaginings of the future (which is the protagonist's present). These retro-future visions which invade the protagonist's reality are imposing and impressive, determined and intensely vital, and yet, the language Gibson uses to evaluate them is strikingly repulsive. When experiencing a vision of a futuristic city in which:

> Spire stood on spire in gleaming ziggurat steps that climbed to a central golden temple tower ringed with the crazy radiator flanges of the Mongo gas stations. You could hide the Empire State Building in the smallest of those towers. Roads of crystal soared between the spires, crossed and recrossed by smooth silver shapes like beads of running mercury. The air was thick with ships: giant

[268] Larry McCaffery, ed., *Across the Wounded Galaxies: Interviews with Contemporary American Science Fiction Writers* (Urbana and Chicago: University of Illinois Press, 1990), p. 140.
[269] McCaffery, *Across the Wounded Galaxies*, p. 141.

> wing-liners, little darting silver things (sometimes one of the quicksilver shapes from the sky bridges rose gracefully into the air and flew up to join the dance), mile-long blimps, hovering dragonfly things that were gyrocopters...[270]

the protagonist immediately off-sets the poetic description by the realisation that the city was "a dream […] thrown up out of the collective yearning of an era."[271]

The city's inhabitants are portrayed through a similar juxtaposition of physical attractiveness and an underlying repulsiveness:

> They frightened me.
>
> They were white, blond, and they probably had blue eyes. They were American. Dialta had said that the Future had come to America first, but had finally passed it by. But not here, in the heart of the Dream. Here, we'd gone on and on, in a dream logic that knew nothing of pollution, the finite bounds of fossil fuel, or foreign wars it was possible to lose. They were smug, happy, and utterly content with themselves and their world. And in the Dream, it was their world. I imagined them thronging the plazas of white marble, orderly and alert, their bright eyes shining with enthusiasm for their floodlit avenues and silver cars. It had all the sinister fruitiness of Hitler Youth propaganda.[272]

What the story offers as a solution to the contaminative invasiveness of the retro-future visions is a total submersion in the cultural reality of the present. The character of that reality is, however, equally negative. The protagonist is told to "[w]atch lots of television, particularly game shows and soaps. Go to porn movies. Ever see Nazi Love Motel? They've got it on cable, here. Really awful. Just what you need. Really bad media can exorcise your semiotic ghosts."[273] The sleaziness and shallowness of electronic media, "the hard evidence of the human near-dystopia we live in" is conveyed through a sexual reference to Nazis, parallel to the negative evaluation of

---

[270] William Gibson, "The Gernsback Continuum," in: *Burning Chrome* (New York: Ace Books, 1987), p. 31.

[271] Gibson, "The Gernsback Continuum," p. 32.

[272] Gibson, "The Gernsback Continuum," p. 32.

[273] Gibson, "The Gernsback Continuum," p. 33.

the old aesthetic and literary paradigm. This parallelism testifies to the postulated continuity of the presence of disgust and its function as the vector of estrangement.

Cyberpunk aesthetics which Gibson's writings did so much to establish showcases how the techno-anxieties are negotiated through disgust. This is particularly visible in the attitude towards the human body. Firstly, though ostensibly interested in immaterial, dislocated digital technologies, cyberpunk insistently and explicitly draws attention to the bodily. According to Dani Cavallaro "[cy]berculture pivots on a contradiction: a growing fascination with the body, testified by all sorts of media, coexists with an increasing infiltration of the body by technologies that seem to take its materiality away."[274] The underlying desire for the removal of the materiality of the body and the transcendence of its physical limitations is a direct mirroring of the animal-nature focus of disgust.

The cyberpunk body can only transcend itself when exposed to violations of its integrity, or as Cavallaro puts it, when "technology penetrates the body and its frail dermal casing."[275] For Scott Bukatman, within the discourse of cyberpunk

> the body is hardly inviolate – it is instead a site of almost endless dissolution. From here the language of terminal identity becomes increasingly de-forming of the human, as the subject is simulated, morphed, modified, retooled, genetically engineered, and even dissolved.[276]

Bodily modification, mutilation, interfacing with technology and techno-biological hybridity which constitute so much of cyberpunk imagery, belong to the category of body envelope violations which are one of the primary sources of disgust, and the category-violating potential of these modifications, the dissolution of the distinction

---

[274] Dani Cavallaro, *Cyberpunk and Cyberculture: Science Fiction and the Work of William Gibson* (London and New Brunswick: The Athlone Press, 2000), p. 75.

[275] Cavallaro, *Cyberpunk and Cyberculture* p. 76.

[276] Bukatman, *Terminal Identity*, p. 20.

between the human and the technological violates the principles of purity which lie at the core of moral disgust responses.

The principle holds true also for those texts which overtly define themselves by the embracement of the speculated future changes, rather than by anxiety. Paul Di Fillipo's "Ribofunk: The Manifesto" argues that both cybernetics and punk music were dead by the time cyberpunk fiction was created, and thus ribofunk (from "ribosome" and "funk") "acknowledges, is informed by and illustrates the tenet that the next revolution – the only one that really matters – will be in the field of biology."[277] In opposing cyberpunk and in embracing the biotechnological revolution Di Fillippo's argument employs language effectively centred on a set of bodily references similar to those which establish the disgustedness of cyberpunk alterity. He argues that

> Ribofunk must be as sensual as sex, as unsparing in sweat, cum, bile and lymph as the the body is prolific in these substances. Moreover, it must possess the same blind imperatives as the body. Crushed and crippled, the body persists, while many times the mind succumbs. We have gone as far as intellectuality can take us. We need a fiction as urgent as hunger or a hard-on. Hot, not cool.[278]

In the *Ribofunk* short story collection, a follow-up to his manifesto, Di Fillippo presents an array of possible applications of the biotechnological revolution. While the general attitude of the short stories is enthusiastic and even frivolous, all the bodily modifications present in the collection are disgust elicitors: from core disgust evoked by skin and bone structure modifications, glandular implants secreting hormones and pheromones to moral disgust accompanying the creation of category violating human-animal hybrids and their sexual exploitation.[279]

---

[277] Paul Di Fillippo, "Ribofunk: A Manifesto," accessed 10 December 2014, http://www.streettech.com/bcp/BCPtext/Manifestos/Ribofunk.html.

[278]Paul Di Fillippo, *Ribofunk* (New York: HarperCollins Publishers, 1998).

[279] Paul Di Fillippo, *Ribofunk* (New York: HarperCollins Publishers, 1998).

Greg Bear's *Darwin's Radio* considers the possibility of spontaneous human speciation and the social and cultural challenges such an event would cause. The speciation is caused by a retrovirus (SHEVA) which causes a pregnant woman infected with it to conceive and then miscarry a severely malformed fetus which leaves behind a fertilized egg. The embryo has fifty-two chromosomes and is a new subspecies of the homo sapiens, a homo sapiens novus, in many ways superior to the old form. It is of note that while the new human subspecies is an upgrade to the old, its appearance is considered by Bear in terms of a disease or an epidemic. The transformation of the genetic code threatens the existence of the established cultural codes. This threat is foregrounded by the monstrous character of the fertilisation process in which the malformation of the intermediary fetus is intensely disgusting:

> The head is severely malformed. The brain is just a nubbin of tissue at the end of a shortened spinal cord. There is no jaw. The eye sockets are open at the side, like a kitten's. The skull looks more like a lemur's, what there is of it. No brain function would have been possible after the first three weeks. No metabolism could have been established after the first month. This thing functions as an organ drawing sustenance, but it has no kidneys, a very small liver, no stomach or intestines to speak of... A kind of heart, but again, very small. The limbs are just little fleshy buttons. It's not much more than an ovary with a blood supply.[280]

The viscerality of the description is particularly striking given that the evolved humans are portrayed in prevailingly positive terms. That their newness and alterity have to be conveyed through such imagery testifies to disgust's central role in creating estrangement.

[280] Greg Bear, *Darwin's Radio* (New York: Random House, 2003), p. 94.

Conclusion

What the preceding discussion illustrates is how an evolved, originally physiological, mechanism plays a role in shaping a cultural phenomenon. Disgust seems to be a primary means of creating estrangement in science fiction. It plays a crucial role in creating physical and ideational alienness of science fictional nova and because of its connection to moralisation allows for a wide range of cognitive and emotional interactions with them. The experience of disgust is transgressive, marginal, and threatening at the same time and these characteristics correlate with the character of science fictional otherness. However, because objects of disgust are, at the same time, intensely fascinating, otherness also becomes attractive. This, in turn, ensures interest and thus enables science fiction to perform its function of mental experimentation.

CONCLUSION

> "*The bough swings in the wind,*
> *the night is deep;*
> *Look at the stars, poor little ape,*
> *and sleep*."
> That one almost made me whoop - what monkeys we are, I thought.
>
> Fritz Leiber, *Big Time*

The study of literature from a Darwinian perspective necessitates a number of paradigmatic and methodological shifts. In terms of paradigmatic reorientation, literary Darwinism entails a focus on the functional relations of literature to evolutionary notions such as adaptiveness or fitness. As these operate mostly on the scale of entire populations, and at a level of high generality, Darwinian Literary Studies turn away from the discourse-oriented post-structuralist paradigm of multiple, local narratives, focusing instead on the common heritage and shared evolutionary experiences of mankind. Granted, literary, or otherwise artistic, creations of different human cultures will significantly differ from one another, and yet, in this view, they will all operate in relation to the same basic needs or problems. Thus, the Darwinian paradigm focuses on the essential unity of mankind and its past and present experiences, rather than on its fragmentation. As Kwame Anthony Appiah puts it, artistic activity provides a connecting factor for all humans "not through identity, but *despite* difference. We can respond to art that is not ours; […] My people – human beings – made the Great Wall of China, the Sistine Chapel, the Chrysler Building: these things were made by creatures like me, through the exercise of skill and imagination."[281]

[281] Kwame Anthony Appiah, *Cosmopolitanism: Ethics in a World of Strangers* (New York: Norton, 2006). p. 41.

The paradigmatic refocus enforces a methodological shift, in which the object of research becomes the search for mechanisms responsible for conditioning the way in which literary works are structured and organised, as well as the links between these works and the adaptive needs in response to which they arise. Since Freudian or Lacanian psychologies, prevalent in theoretical studies despite their relatively marginal significance in contemporary psychology, either ignore or are outright at odds with the evolutionary approach, DLS turns towards both more mainstream psychology, which often includes an evolutionary component, and the less established evolutionary psychology.

These changes in focus, obviously, put Darwinian Literary Studies at odds with the preferred methodologies of much of literary theory, as evidenced by the highly militant tone of some if its programmatic manifestos, which certainly does not facilitate the wider adoption, or even recognition of DLS. The situation is exacerbated by the fact that while psychoanalytical approaches are fairly well established and known within literary theory, the types of psychology preferred by DLS are not. This creates a practical obstacle in its wider adoption, namely, the necessity to acquire a certain level of familiarity with, if not expertise in, a vast area of knowledge that is non-psychoanalytical psychology.

The presence of these difficulties is unfortunate. With its background in biology and intense stress of interdisciplinarity inherent in the idea of scientific consilience, DLS is, potentially, a means of bridging the gap between the natural sciences and the humanities. As Dominika Oramus concludes, "Darwinism can provide the two cultures with a common language, and thus eliminate the illusory differences caused by miscommunication. […] It can become a *lingua franca* of

science."[282] The establishment of such a unified science, could open possibilities to ask and answer questions previously unaddressed by either of the two great branches.

This dissertation was written with the hope that incorporating DLS into science fiction studies can offer a contribution to the field by resolving some of the antagonistic paradoxes outlined earlier. The immediate goal of the study was to approach the phenomenon of science fiction from an evolutionarily oriented perspective in order to establish what the function and purpose of the genre is and to analyse which mechanisms are responsible for shaping the patterns and formulas of science fiction's poetics. The discussion demonstrated that because it stimulates mental and cognitive experimentation, fiction in general, and science fiction in particular, displays a decisively epistemological orientation. This gives it the potential to facilitate learning, increase the cultural depository of available knowledge and, by exposing the reader to repeated contacts with intense novelty, through the effect of "mere exposure," enhance the attitude toward the general ideas of otherness, alterity and change, thus serving to lessen the possible "future shock.".

Further, it was argued that generation of heterotopic spaces and paraspaces in science fiction, and the narrative treatment of these spaces, correlates with the evolutionary understanding of how humans approach new environments. Those environments which are rich in Mystery and thus appear to offer many opportunities for exploration and interaction are considered attractive and are preferred over those which appear boring. The accumulation of strangeness and alterity, which is characteristic of heterotopias and paraspaces of science fiction, ensures their mysteriousness and is conducive to the evocation of interest in these spaces, which invites exploration and thus makes mental experimentation possible. Such treatment

[282] Oramus, *Darwinowskie Paradygmaty*, p. 369-370.

of fictional spaces can be a form of a cultural reinforcement of the innate exploration drive.

Finally, the function of disgust as a primary means of evoking estrangement in science fiction was discussed. Evidence was presented how disgust plays a role in the narrative shaping of embodied and technological aliennes. Because of the paradoxical character of this emotion, whose elicitors are at the same time intensely repelling and alluring, and because of its link with the process of moralisation, disgust guarantees interest in the fictional novelty and opens it to a number of possible interactions with, which in turn enable the cognitive experimentation described earlier to take place.

The evidence presented in the study confirms that science fiction seems to possess features which could make it adaptively beneficial and that it is narratively and conceptually organised around features and strategies which allow it to culturally reinforce adaptive psychological mechanisms. The analysis of these mechanisms allows to answer the main research questions and to achieve the direct goal of the study

In a wider, less direct, sense, the dissertation serves to testify to the validity of the Darwinian approach and its significance to literary theory in general. To be sure, there are obstacles to a wider recognition of DLS, some of which are of emotional and some of which are of practical nature. In addition, the totalising, large scale scope of DLS makes it ill-suited to provide more detailed, reflective analyses of literary works. Nor is DLS, perhaps despite the ambitions of some of its most vocal proponents, able to constitute itself as a completely independent field of study. It necessarily must rely on, and draw from, the conceptual apparatuses already present in the more standard types of literary theory. However, with these reservations in

mind, the ultimate conclusion appears to be that Darwinian Literary Studies can, instead of supplanting, enrich the existing body of literary knowledge.

BIBLIOGRAPHY

Appiah, Kwame Anthony. Cosmopolitanism: Ethics in a World of Strangers. New York: Norton, 2006.

Argyros, Alexander. "Narrative and Chaos." *New Literary History*, Vol. 23, No. 3, (1992), 659-673.

Bailey, Kenneth V. "Aliens for the Alienated" In: *Storm Warnings. Science Fiction Confronts the Future*. Edited by George Slusser. Carbondale: Southern Illinois University Press, 1987.

Ballard, J.G. *The Drowned World*. New York: Harper Perennial, 2005 [1962].

Baxter, Brian. *A Darwinian Worldview: Sociobiology, Environmental Ethics, and the Work of E.O. Wilson.* Burlington: Ashgate, 2007.

Bear, Greg. *Darwin's Radio*. New York: Random House, 2005.

Benford, Gregory. "Aliens and Knowability: A Scientist's Perspective." In: *Bridges to Science Fiction*. Edited by George Slusser et al.. Carbondale: Southern Illinois University Press, 1980.

Benford, Gregory. "Effing the Ineffable." In: *Aliens. The Anthropology of Science Fiction.* Edited by George S. Slusser and Eric S. Rabkin. Carbondale and Evansville: Southern Illinois University Press, 1987.

Best, Steven and Douglas Kellner, *The Postmodern Turn*. New York: Guilford Press, 1997.

Bethesda Game Studios. *Fallout 3*. Bethesda Softworks, 2008.

Bethesda Game Studios. *Fallout 4.* Bethestda Softworks, 2015.

Black Isle Studios. *Fallout 2.* Interplay Entertainment, 1998.

Borgerhoff Mulder, Monique. "Human behavioural ecology." In: *Behavioural Ecology: an Evolutionary Approach.* Edited by J. Krebs, N. Davies. Oxford: Blackwell Scientific Publications, 1991.

Bornstein, Robert F. “Exposure and Affect: Overview and Meta-Analysis of Research, 1968-1987.” *Psychological Bulletin*. Vol. 106, No.2 (1989), 265-289.

Bornstein, Robert F. and Amy R. Kale, Karen R. Cornell. “Boredom as a Limitng Condition on the Mere Exposure Effect.” *Journal of Personality and Social Psychology*. Vol. 58, No.5 (1990), 791-800.

Boyd, Brian. “Evolutionary Theories of Art.” In: *The Literary Animal. Evolution and the Nature of the Narrative*, Edited by Jonathan Gottschall and David Sloan Wilson. Evanston: Northwestern University Press, 2005.

Boyd, Brian. “Theory Is Dead – Like a Zombie.” *Philosophy and Literature*, Vol. 30, No. 1 (2006), 289-298.

Bradbury, Ray. “The Strawberry Window,” in: *The Day It Rained Forever*. London: Hart-Davis, 1959.

Broderick, Damien. *Reading by Starlight. Postmodern Science Fiction*. London and New York: Routledge, 1995.

Bruner, Jerome. *Acts of Meaning.* Cambridge: Harvard University Press, 1990.

Bukatman, Scott. *Terminal Identity. The Virtual Subject in Postmodern Science Fiction*. Durham and London: Duke University Press, 1993.

Buss, David. *Evolutionary Psychology: The New Science of the Mind*. London: Allyn and Bacon, 1999.

Buss, David. *The Evolution of Desire: Strategies of Human Mating*. New York: HarperCollins, 1994.

Cameron, James. Dir., *Aliens*. 20th Century Fox, 1986.

Carroll, Joseph. “An Evolutionary Paradigm for Literary Study.” *Style.* Vol. 42, Nos.2-3 (2008), 103-135.

Carroll, Joseph. “Evolutionary Approaches to Literature and Drama.” In: *The Oxford Handbook of Evolutionary Psychology*. Edited by R. Dunbar, L. Barret. Oxford: Oxford University Press, 2007.

Carroll, Joseph. “Poststructuralism, Cultural Constructivism and Evolutionary Biology,” *Symploke.* Vol.4, Nos. 1-2. (1996), 203-219.

Carroll, Joseph. *Literary Darwinism. Evolution, Human Nature and Literature.* New York: Routledge, 2004.

Cavallaro, Dani. *Cyberpunk and Cyberculture: Science Fiction and the Work of William Gibson*. London and New Brunswick: The Athlone Press, 2000.

Cosmides, Leda and John Tooby. “From evolution to behavior: evolutionary psychology as the missing link.” In: *The Latest on the Best: Essays on Evolution and Optimality*. Edited by J. Dupré, Cambridge MA: MIT Press, 1987.

Crews, Frederick. “Apriorism for Empiricists.” *Style*, Vol. 42, Nos. 2-3 (2008), 155-160.

Csicsery-Ronay Jr., Istvan. *The Seven Beauties of Science Fiction*. Middletown: Wesleyan University Press, 2008.

Csicsery-Ronay, Istvan. „An Elaborate Suggestion.” *Science Fiction Studies.* Vol. 20, No. 3 (1993), 457-464.

Darwin, Charles. *The Descent of Man, And Selection in Relation to Sex.* Princeton: Princeton University Press, 1981 [1871].

Darwin, Charles. *The Expression of the Emotions in Man and Animals*. Cambridge: Cambridge University Press, 2009 [1890].

Dawkins, Richard. *The Selfish Gene*. Oxford: Oxfprd University Press, 1976.

Dewey, John. *Experience and Education.* New York: Touchstone, 1997 [1938].

Di Fillippo, Paul. “Ribofunk: A Manifesto.” Accessed 10 December 2014. http://www.streettech.com/bcp/BCPtext/Manifestos/Ribofunk.html

Di Fillippo, Paul. *Ribofunk*. New York: Harper Collins Publishers, 1998.

Dissanayake, Ellen. What Is Art For? Seattle: University of Washington Press,1988.

Dissanayake, Ellen. *Homo Aestheticus: Where Art Comes from and Why*. New York: Free Press, 1992.

Dissanayake, Ellen. *Art and Intimacy: How the Arts Began.* Seattle: University of Washington Press, 2000.

Douglas, Mary. *Purity and Danger. An Analysis of Concepts of Pollution and Taboo*. London and New York: Routledge, 2001 [1966].

Dreyfus, Hubert and Sean Kelly."Heterophenomenology: Heavy-handed Sleight-of-hand." *Phenomenology and the Cognitive Sciences*, Vol. 1 (2007), 45-55.

Durham, William. *Coevolution: Genes, Culture and Human Diversity.* Stanford: Stanford University Press, 1991.

Easterlin, Nancy. "Making Knowledge: Bioepistemology and the Foundations of Literary Theory." In: *Theory's Empire*, Edited by D. Patai, W. Corral. New York: Columbia University Press, 2005.

Endler, Joseph. *Natural Selection in the Wild*. Princeton, NJ: Princeton University Press, 1986.

Evans, Dylan. "From Lacan to Darwin." In: *The Literary Animal. Evolution and the Nature of the Narrative.* Edited by Jonathan Gottschall and David Sloan Wilson. Evanston: Northwestern University Press, 2005.

Foley, Robert. "The Adaptive Legacy of Human Evolution: A Search for the Environment of Evolutionary Adaptedness,"*Evolutionary Anthropology.* Vol. 4, No. 6 (1996), 194-203.

Foley, Robert. *Unknown Boundaries: Exploring Human Evolutionary Studies*. Cambridge: Cambridge University Press, 2006.

Foucault, Michel. "Of Other Spaces." *Diacritics.* Vol. 16, No. 1 (1986), 22-27.

Fukuyama, Francis. *Our Posthuman Future. Consequences of the Biotechnology Revolution.* New York: Picador, 2002.

Gasiorek, Andrzej. *J.G. Ballard*. Manchester: Manchester University Press, 2005.

Gibson, James J. *The Ecological Approach to Visual.* Perception. New York: Psychology Press, 1986.

Gibson, William. “The Gernsback Continuum.” In: *Burning Chrome*. New York: Ace Books, 1987.

Gottschall, Jonathan. “The Tree of Knowledge and Darwinian Literary Study,“ *Philosophy and Literature*, Vol. 27, No.2, (2003), *Project MUSE*.Web.(10 Dec, 2011).

Gould Stephen Jay and Elisabeth Vrba. “Exaptation – A Missing Term in the Science of Form.” *Paleobiology*, Vol. 8, No. 1 (1982), 4-15.

Gould, Stephen J. *Bully for Brontosaurus. Reflections in Natural History*. New York: Norton & Co.1991.

Harshaw, Benjamin. “Fictionality and Fields of Reference: Remarks on a Theoretical Framework.” *Poetics Today*. Vol. 5, No.2 (1984), p. 227-251.

Haidt, Jonathan et al. “Body, Psyche and Culture: The Relationship Between Disgust and Morality.” *Psychology and Developing Countries.* Vol. 9, No.1 (1997), 107-131.

Hamilton, William. “The Genetical Evolution of Social Behaviour I.” *Journal of Theoretical Biology* Vol. 7 (1964), 1-16.

Harmon-Jones, Eddie and John J.B. Allen. “The Role of Affect in the Mere Exposure Effect: Evidence from Psychophysiological and Individual Differences Approaches.” *Personality and Social Psychology Bulletin.* Vol. 27, No.7 (July 2001), 889-898.

Hayek, Friedrich A., “Economics and Knowledge.” In: *Individualism and Economic Order*. Chicago: Chicago University Press, 1958.

Hayek, Friedrich A., *Law, Legislation and Liberty*. London: Routledge, 1998.

Heinlein, Robert A. *Methuselah’s Children* New York:. New American Library,1960[1958].

Heinlein, Robert A. *The Puppet Masters*. New York: Ballantine Books, 1986 [1951].

Herbert, Frank. *God Emperor of Dune*. New York: Putnam, 1981.

Herzog Thomas R. and Gregory Smith. “Danger, Mystery and Environmental Preference.” *Environment and Behavior*. Vol. 20, No. 3 (1988), 320-344.

http://boinc.bakerlab.org/rosetta/. 16 May, 2012.

http://boinc.bakerlab.org/rosetta/rah_about.php. 16 May, 2012.

http://folding.stanford.edu/English/Papers. 16 May, 2012.

http://folding.stanford.edu/English/Science. 16 May, 2012.

http://folding.stanford.edu/English/Stats. 16 May, 2012.

http://i.top500.org/system/176544. 16 May, 2012.

Hughes, James. *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future*. Westview Press, 2004.

Hull, D.,"Taking Memetics Seriously: Memetics Will be What We Make It" in: *Darwinizing Culture: the Status of Memetics as a Science*. Edited by R. Augner. Oxford: Oxford University Press, 2000.

Huntington, John. "Discriminating Among Friends: The Social Dynamics of the Friendly Alien." In: *Aliens. The Anthropology of Science Fiction*. Edited by George S. Slusser and Eric S. Rabkin. Carbondale and Evansville: Southern Illinois University Press, 1987.

Huntington, John. "Science Fiction and the future." In: *Science Fiction: A Collection of Critical Essays*, Edited by Mark Rose. Englewood Cliffs, NJ: Prentice-Hall, 1976.

Interplay Entertainment. *Fallout*. Interplay Entertainment, 1997.

Irons William and Lee Cronk. "Two Decades of a New Paradigm." In: *Adaptation and Human Behaviour: An Anthropological Perspective*. Edited by L. Cronk, N. Chagnon, W. Irons, . New York: Aldine de Gruyter, 2000.

Irons, William. "Adaptively Relevant Environments versus the Environment of Evolutionary Adaptedness." *Evolutionary Anthropology* Vol. 6(1998), 194-204.

Johnson, Steven. *Everything Bad is Good for You.* New York: Riverhead Books, 2005.

Jones, Gwyneth. *Deconstructing the Starships: Science, Fiction and Reality*. Liverpool: Liverpool University Press, 1999.

Kaplan, Stephen. “Aesthetics, Affect and Cognition. Environmental Preference from an Evolutionary Perspective.” *Environment and Behavior.* Vol. 19, No.1 (1987), 3-39.

Kaplan, Stephen. “Environmental Preference in a Knowledge-Seeking, Knowledge-Using Organism.” In: *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. Edited by J.H. Barkow, L.Cosmides, J. Tooby. Oxford: Oxford University Press, 1992.

Kingsolver J., et al. “The strength of phenotypic selection in natural populations.” *American Naturalist* Vol. 157 (2001), 245-261.

Kolnai, Aurel. “Der Ekel.” Given in: Winfired Menninghaus, *Disgust. The Theory and History of a Strong Sensation*, trans. Howard Eiland and Joel Golb. Albany: State University of New York Press, 2003.

Kramnick, Jonathan. “Against Literary Darwinism.” *Critical Enquiry*. Vol. 37 (2011), 315-347.

Laland, Kevin and Gillian Brown. *Sense and Nonsense: Evolutionary Perspectives on Human Behaviour*. Oxford: Oxford University Press, 2002.

Levin, Richard. “The New Interdisciplinarity in Literary Criticism,” in: *After Poststructuralism: Interdisciplinarity and Literary Criticism*. Edited by Nancy Easterlin and Barbara Riebling. Evanston: Northwestern University Press, 1993.

Lewontin, R. and L. Kamin, S. Rose. *Not in Our Genes: Biology, Ideology and Human Nature*. London: Penguin Books, 1984.

Lorenz, Konrad. “Kant’s Doctrine of the A Priori in the Light of Contemporary Biology.” In: *Learning, Development and Culture: Essays in Evolutionary Epistemology*, Edited by Henry Plotkin. Chichester: Wiley, 1982.

Lorenz, Konrad. *Behind the Mirror*. Translated by Ronald Taylor. New York: Harcourt Brace Yovanovich, 1979.

Lorenz, Konrad. *Evolution and Modification of Behaviour*. London: Methuen,1965.

Lumsden, Charles and Edward O. Wilson, *Genes, Mind and Culture: The Coevolutionary Process*. Cambridge, MA: Harvard University Press, 1981.

Malmgren, Carl. "Self and Other in SF: Alien Encounters." *Science Fiction Studies*, Vol. 20, No. 1 (1993), 15-33.

Maynard Smith, John. "Group Selection and Kin Selection." *Nature.* Vol. 201 (1964), 1145-1147.

Mayr, Ernst. *Evolution and the Diversity of Life. Selected Essays.* Cambridge: Harvard University Press, 1976.

McCaffery, Larry. *Across the Wounded Galaxies: Interviews with Contemporary American Science Fiction Writers.* Urbana and Chicago: University of Illinois Press. 1990.

McDougall, Walter A. …*The Heavens and The Earth: A Political History of the Space Age*. Baltimore and London: The Johns Hopkins University Press, 1997.

McGinn, Colin. *The Meaning of Disgust*. Oxford: Oxford University Press, 2011.

Mihail, Roco and William S. Bainbridge. *Converging Technologies for Improving Human Performance*. Washington, D.C.: National Science Foundation, 2002.

Miller, D.G., "Bad Writing" in: *Theory's Empire*, Edited by D. Patai, W. Corral. New York: Columbia University Press, 2005.

Miller, Geoffrey. *Mating Mind.* New York: Doubleday, 2000.

Miller, Geoffrey. "Arts of Seduction." In: *Evolution, Literature and Film. A Reader*. Edited by: Brian Boyd, Joseph Carroll and Jonathan Gottschall. New York: Columbia University Press, 2010.

Miller, Walter M. *A Canticle for Leibowitz.* New York, Bantam Books, 1961.

Miller, William Ian. *The Anatomy of Disgust*. Cambridge: Harvard University Press, 1997.

Mitcham, Carl. *Thinking Through Technology. The Path Between Engineering and Philosophy*. Chicago and London: The University of Chicago Press, 1994.

Obsidian Entertainment. *Fallout New Vegas*. Bethesda Softworks, 2010.

Odling-Smee, F. John and Kevin Laland, Marcus Feldman. "Niche Construction." *The American Naturalist*. Vol. 147, No.4 (April 1996), p. 641-648.

Oramus, Dominika. *Darwinowskie paradygmaty. Mit teorii ewolucji w culture współczesnej*. Kraków: Copernicus Center Press, 2015.

Orians, Gordon and Judith Heerwagen, "Evolved Responses to Landscapes." In: *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*. Edited by J.H. Barkow, L.Cosmides, J. Tooby. Oxford: Oxford University Press, 1992.

Parrinder, Patrick. "Re-Visitng Suvin's Poetics of Science Fiction," in: *Learning from Other Worlds: Estrangement, Cognition and the Politics of Science Fiction and Utopia*. Edited by P. Parrinder. Liverpool: Liverpool University Press, 2000.

Parrinder, Patrick. "The Alien Encounter: Or, Ms Brown and Mrs Le Guin," *Science Fiction Studies*, Vol. 6, No. 17 (1979). Accessed 26 October, 2014. http://www.depauw.edu/sfs/backissues/17/parrinder17.htm

Pinker, Steven. "Toward a Consilient Study of Literature." *Philosophy and Literature*, Vol. 31, No.1. (2007) *Project MUSE*. Web.. 10 Dec, 2011.

Pinker, Steven. *How the Mind Works*. London: Penguin Books, 1998.

Plotkin, Henry. *Evolutionary Worlds Without End*. Oxford: Oxford University Press, 2010.

Popper, Karl. "Evolutionary Epistemology." In: *Evolutionary Theory: Paths into the Future*, Edited by J.W. Pollard. Chichester: Wiley, 1984.

Popper, Karl. *Objective Knowledge: An Evolutionary Approach*. Oxford, Oxford University Press, 1979.

Popper, Karl. *Objective Knowledge: An Evolutionary Approach*. Oxford: Oxford University Press, 1979.

Potts, Rick. "Variability Selection in Hominid Evolution." *Evolutionary Anthropology*. Vol. 7, No. 3 (1998), 81-96.

Roberts, Adam. *Science Fiction.* London: Routledge, 2000.

Roddenbery, Gene. Opening narration, *Star Trek*. NBC, September 8, 1966).

Rozin, Paul and April Fallon. "A Perspective on Disgust." *Psychological Review,* Vol. 94, No. 1 (1987), 23-41.

Rozin, Paul and Jonathan Haidt, Clark R. McCauley, "Disgust." In: *Handbook of Emotions 3rd Edition*. Edited by Michael Lewis, Jeanette Haviland-Jones and Lisa Feldman Barret. New York and London: The Guilford Press, 2008.

Rozin, Paul and Jonathan Haidt, Katrina Fincher. "From Oral to Moral," *Science*, Vol. 323 (2009), 1179-1180.

Rozin, Paul et al., "The CAD Hypothesis: A Mapping Between Three Moral Emotions. Contempt, Anger Disgust) and Three Moral Codes: Community, Autonomy, Divinity." *Journal of Personal and Social Psychology*. Vol. 76, No. 4 (1999), 574-586.

Rozin, Paul. "Selection of Food by Rats, Humans and Other Animals." In: *Advances in the Study of Behavior*. Edited by Jay S. Rosenblatt. New York: Academic Press, 1976.

Rozin, Paul. "Towards a Psychology of Food and Eating: From Motivation to Module to Model to Marker, Morality, Meaning and Metaphor." *Current Directions in Psychological Science*, Vol. 5, No. 1 (1996), 18-24.

Sanfey, Alan et al. "The Neural Basis for Economic Decision Making in the Ultimatum Game." *Science*, Vol. 300, (2003), 1755-1758.

Season 2 Trailer, *Dr Who*. BBC One, 2005).

Segerstralle, Ullica. *Defenders of the Truth. The Battle for Science in the Sociobiology Debate and Beyond.* Oxford: Oxford University Press, 2000.

Smith, Eric A. "Three Styles in the Evolutionary Analysis of Human Behavior." In: *Adaptation and Human Behaviour: An Anthropological Perspective*. Edited by L. Cronk, N. Chagnon, W. Irons, . New York: Aldine de Gruyter, 2000.

Smith, Michael Marshall. “Foreword,” in: *Lost in Space. Geographies of Science Fiction*. London and New York: Continuum, 2002.

Sorensen, Roy A. *Thought Experiments.* New York: Oxford University Press, 1992.

Sperber, Dan. “An objection to the memetic approach to culture.” In: *Darwinizing Culture: the Status of Memetics as a Science,* Edited by R. Augner. Oxford: Oxford University Press, 2001.

Suvin, Darko. *Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre.* New Haven: Yale University Press, 1979.

Swirski, Peter. *Of Literature and Knowledge: Explorations in Thought Experiments, Evolution and Game Theory.* New York: Routledge, 2007.

Symons, Donald. “Adaptiveness and Adaptation.” *Ethology and Sociobiology.* Vol.11, Nos. 4-5, (1990), 427-444 .

Tooby John and Leda Cosmides. “The past explains the present: Emotional adaptations and the structure of ancestral environments.” *Ethology and Sociobiology*. Vol. 11 (1990), 375-424.

Tooby, John and Leda Cosmides. "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and the Arts,” *SubStance*, Vol. 30, Nos. 1-2 (2001), 6-27.

Trivers, Robert. “The Evolution of Reciprocal Altruism.” *The Quarterly Review of Biology*. Vol. 46 No. 1 (1971), 35-57.

Turner, Victor. *The Ritual Process. Structure and Anit-Structure.* Ithaca: Cornell University Press, 1991.

Verne, Jules. *20,000 Leagues Under the Seas*, Project Gutenberg, accessed 20 March, 2014, https://www.gutenberg.org/files/2488/2488-h/2488-h.htm

Waddington, Conrad, H. "Paradigm for an Evolutionary Process." In: *Sketching Theoretical Biology: Toward a Theoretical Biology Vol.2,* Edited by C.H. Waddington. New Brunswick: Transaction Publishers, 2010.

Wells, H.G. *The First Men in the Moon*. Oxford: Oxford University Press, 1995 [1901].

Wells, H.G. *The War of the Worlds*, Project Gutenberg, accessed 20 March, 2014, https://www.gutenberg.org/files/36/36-h/36-h.htm. 1898).

Wilson, David, S. "Evolutionary Social Constructivism" in: *The Literary Animal.* Edited by J. Gottschall, D.S. Wilson. Evanston: Northwestern University Press, 2005.

Wilson, Edward O. *Consilience: The Unity of Knowledge*. London: Little, Brown and Co., 1998.

Wilson, Edward O. *Naturalist.* Washington, DC: Island Press, 1994. p. 332-333.

Wilson, Margo and Martin Daly. "Human Evolutionary Psychology and Animal Behaviour." *Animal Behaviour.* Vol. 57 (1999), 509-519.

Zajonc, Robert B. "Attitudinal Effects of Mere Exposure." *Journal of Personality and Social Psychology Monograph Supplement.* Vol. 9, No.2, Part 2 (June 1968).

SUMMARY

The object of the study is to approach the phenomenon of science fiction from an evolutionarily oriented perspective in order to analyse whether it is possible to assign it an adaptive function and to establish links between persistent narrative patterns and regularities present in science fiction, and evolved psychological mechanisms present in humans, which would validate the central theoretical premise of Darwinian Literary Studies.

Chapter 1 provides a contextual overview of evolutionary attempts at analysing human behaviour in terms of it being linked with innate, genetic, predispositions. It also introduces Edward O. Wilson's idea of scientific consilience which forms the conceptual basis for the development of Darwinian Literary Studies.

Chapter 2 introduces the precepts of Darwinian Literary Studies, discusses DLS in relation to the dominant literary theoretical paradigm and argues that fiction in general and science fiction in particular, because it stimulates mental and cognitive experimentation, displays a decisively epistemological orientation. This gives it the potential to facilitate learning, particularly in reference to possible future contacts with the unknown and the novel. While there is no definite proof of science fiction's adaptive usefulness, this focus on experimentation allows for a tentative claim to be made that its cultural presence might be, potentially, fitness-enhancing.

Chapter 3 argues that generation of heterotopic spaces and paraspaces in science fiction and the narrative treatment of these spaces correlates with the evolutionary understanding of how humans interact with and approach new environments. Those environments which are rich in Mystery and thus appear to offer many opportunities for exploration and interaction are considered attractive and are preferred over those which appear boring. The accumulation of strangeness and

alterity which characterises the heterotopias and paraspaces of science fiction ensures their mysteriousness and is conducive to the evocation of interest in these spaces which invites exploration and thus makes mental experimentation possible. It is also argued that such treatment of fictional spaces can be a form of a cultural reinforcement of the innate exploration drive.

Chapter 4 considers the function of disgust as a primary means of evoking estrangement in science fiction. Because of the paradoxical character of this emotion, whose elicitors are at the same time intensely repelling and alluring, and because of its link with the process of moralisation, disgust guarantees interest in the fictional novelty and opens it to a number of possible interactions with. Evidence is presented how disgust plays a role in the narrative shaping of embodied and technological aliennes.

The evidence presented in the study appears to confirm its initial hypotheses: science fiction is narratively and conceptually organised around innate psychological mechanisms and seems to possess features which could make it adaptively beneficial and. This, at least partially, testifies to the correctness of the theoretical framework of Darwinian Literary Studies.

STRESZCZENIE

Celem rozprawy jest analiza fantastyki naukowej z perspektywy literaturoznawstwa darwinistycznego w celu ustalenia jakie mechanizmy stoją za fabularnymi i narracyjnymi schematami poetyki fantastycznonaukowej; zbadania, czy możliwe jest aby fantastyka naukowa pełniła funkcję adaptacyjną, oraz, pośrednio, zbadanie użyteczności literaturoznawstwa darwinistycznego jako narzędzia analizy teoretycznej.

Rozdział pierwszy stanowi przegląd dotychczasowych badań skupiających się na wpływie uwarunkowań genetycznych i adaptacyjnych na formy i sposoby ludzkich zachowań kulturowych oraz przybliża pojęcie konsiliencji wprowadzone przez Edwarda O. Wilsona a stanowiące intelektualną podstawę do rozwoju ewolucyjnie zorientowanych badań literackich.

Rozdział drugi przybliża cele i metodologię literaturoznawstwa darwinistycznego, w dużej mierze wyrastającego z opozycji wobec dominujących obecnie w Teorii trendów poststrukturalistycznych. Odrzucenie centralnych dla postrukturalizmu założeń, pozwala na paradygmatyczną reorientację badań literackich, co z kolei otwiera drogę do analizy aktywności artystycznej, w tym także literackiej, w relacji do biologicznie motywowanych potrzeb adaptacyjnych. Rozdział stanowi próbę wykazania, że fantastyka naukowa, poprzez swoją koncentrację na eksperymentach poznawczych, myślowych i intelektualnych skupionych na interakcji z nowym, odmiennym i niezwykłym, stanowi ważny element w procesie zdobywania niezbędnej wiedzy o świecie, niemożliwej do zdobycia inaczej niż poprzez kontakt z fikcyjnymi fabułami.

Rozdziały trzeci i czwarty podejmują analizę schematów narracyjnych obecnych w fantastyce naukowej. Pierwszy z nich skupia się na heterotopijnym, a więc odmiennym i alternatywnym charakterze przestrzeni obecnych w fantastyce naukowej. Odmienność ta sprawia, że przestrzenie fantastyki zawsze są nieprzewidywalne, potencjalnie groźne i obiecujące równocześnie. Taki charakter przestrzeni lub krajobrazu, jak pokazują badania z zakresu psychologii ewolucyjnej, jest dla człowieka najatrakcyjniejszy, co w przypadku fantastyki naukowej zapewnia, że jej treść będzie dla czytelnika interesująca. To uchwycenie i zapewnienie uwagi stanowi zachętę do intelektualnej eksploracji, a ta może odgrywać rolę adaptacyjną.

Rozdział czwarty pokazuje, że elementem kluczowym dla przedstawienia fantastycznonaukowego uniezwyklenia poznawczego (*cognitive estrangement*) jest obecność obrzydzenia. Paradoksalny charakter tego uczucia, wzbudzającego równocześnie odrzucenie i fascynację, domagającego się natychmiastowej uwagi i reakcji, gwarantuje zainteresowanie czytelnika elementem odmienności i, ponownie, otwiera go na szeroką gamę interakcji poznawczych.

Przedstawione analizy pozwalają odpowiedzieć na postawione w rozprawie pytania dotyczące schematyczności fantastyki naukowej, jej potencjalnych funkcji poznawczo-adaptacyjnych oraz pokazują użyteczność literaturoznawstwa darwinistycznego.